Edith V. Pearce.
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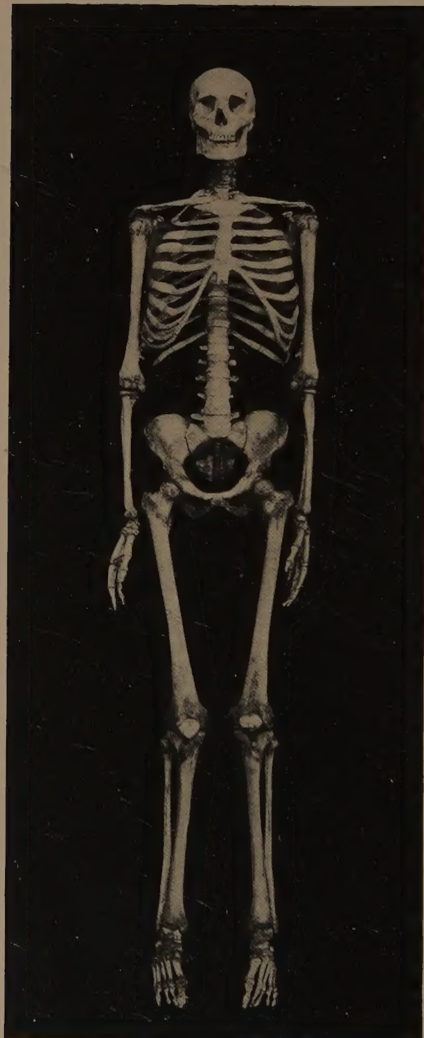
SURGICAL NURSING



Normal Skeleton.

SURGICAL NURSING

AND

The Principles of Surgery for Nurses

BY

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LECTURER ON SURGICAL NURSING TO THE PROBATIONERS OF THE LONDON HOSPITAL AND TO THE NURSES OF THE ROYAL WATERLOO HOSPITAL FOR CHILDREN AND WOMEN; SURGEON TO OUT-PATIENTS, ROYAL WATERLOO HOSPITAL; SURGICAL REGISTRAR, LONDON HOSPITAL; EXAMINER TO NURSES, WESTMINSTER HOSPITAL

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TO

THE MATRON

AND

SISTERS OF THE LONDON HOSPITAL

WITHOUT WHOSE HELP

THIS BOOK WOULD NOT HAVE BEEN WRITTEN

PREFACE

The basis of this book is a series of lectures on Surgical Nursing given to the probationers at the London Hospital.

The author has endeavoured to give in a brief, concise way the principles upon which modern surgical treatment is founded, as well as the details of treatment from the nurse's point of view.

Modern nursing has passed beyond the stage of passive obedience. The active strides made by surgery in the past few years demand a great increase of knowledge on the part of the nurse, who must understand the principles upon which the surgeon is working in order to render him efficient aid.

The increase in the amount of work in surgical wards demands greater specialization, and the surgeon requires the nurse to be able to carry out the preparation of the patient for operation and the routine after-treatment without special orders being given; and, whilst the direction of the treatment remains in his hands, he leaves the details in the hands of the nurse.

In surgical emergencies the nurse must also be prepared to formulate and carry out treatment until the

arrival of the surgeon, and the efficiency of her treatment will depend upon her knowledge of surgical principles and the method of her application of them.

The various methods of after-treatment described in this book are those commonly in use at the London Hospital, and although dogmatic statements have been made as to the quantities of food, etc., to be given, the author is well aware that experience will suggest modifications to suit various patients.

Although this book is written especially for nurses, it is hoped that it will prove useful to those junior students who wish for an elementary guide to the principles of surgery, and to recently-qualified men who desire to know the details of surgical nursing as carried out in one of our large hospitals.

The author wishes to thank Mr. H. A. Fairbank, M.S., F.R.C.S., for valuable hints on the treatment of cases of intubation, and Mr. Swainson, F.R.C.S., for his help in correcting the proofs, and for many useful suggestions.

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CONTENTS

CHAPTER I

INTRODUCTION

CHAPTER II

INFLAMMATION

CHAPTER III

WOUNDS

CHAPTER IV

ACTION OF MICRO-ORGANISMS AND SPECIFIC INFECTIOUS FEVERS

CHAPTER V

HÆMORRHAGE

CHAPTER VI

SHOCK AND ASPHYXIA

CHAPTER VII

NEW GROWTHS

CHAPTER VIII

BURNS AND SCALDS

CHAPTER IX

THE OPERATION

CHAPTER X

EMERGENCY ABDOMINAL OPERATIONS

CHAPTER XI

ᴊEOTOMY AND INTUBATION

CHAPTER XII

TONGUE AND MOUTH OPERATIONS

CHAPTER XIII

OPHTHALMIC NURSING

CHAPTER XIV

FRACTURES

CHAPTER XV

FRACTURED SPINE

CHAPTER XVI

NURSING OF HEAD INJURIES

CHAPTER XVII

NURSING OF RECTAL CASES

CHAPTER XVIII

URINARY CASES

CHAPTER XIX

BANDAGING

CHAPTER XX

INFANTS

CHAPTER XXI

MASSAGE

LIST OF ILLUSTRATIONS

FIGURES IN THE TEXT

SURGICAL NURSING

CHAPTER I

INTRODUCTION

Cleanliness and rest—Methods of infection and their prevention—Hands—Instruments—Ligatures and sutures—Sponges—Bowls, trays, etc.—Water—Dressings—Mackintoshes—Hands—Methods of procuring rest.

To understand the principles of surgery and surgical treatment, it is necessary to have some knowledge of the following subjects: anatomy, physiology, pathology, and bacteriology.

1. **Anatomy** is the science that deals with the structure of the body. It describes the various organs found in the human body, and their relationships to one another. It has been said that a nurse requires to know surface anatomy only, so that she can recognise the various regions of the body referred to by the surgeon. In the main, this is correct; but the modern nurse must also have some knowledge of the principal bloodvessels, nerves, and muscles, for in surgical emergencies, such as hæmorrhage, she must formulate treatment and carry it out, and not wait for orders, and this it will be impossible to do properly if her knowledge of anatomy is defective.

2. **Physiology** is the science that deals with the functions of the organs of the body, such as the function of digestion and the secretion of urine. The different methods of feeding, both before and after operation, depend upon a knowledge of this subject.

3. **Pathology** is the science of disease. It is important to bear in mind that patients are not in a normal condition, and the bodily functions are not carried out in the same way as in health. It is the departures from the normal standard that are the symptoms of disease. A nurse must understand broadly—if not in detail—the disease which she is nursing; she should know whether an operation is likely to be performed or not, whether the disease is necessarily fatal, and what emergencies and complications are likely to arise during the course of the case, so that she may be prepared for them should they occur.

4. **Bacteriology.** — This is really a part of pathology, and is the science which deals with micro-organisms, their methods of growth, and the diseases they cause. Micro-organisms play an enormous part in the modern ideas of the cause of disease, and to get rid of them most surgical technique is planned. At the present time it is believed that most diseases —and certainly all diseases associated with suppuration—are caused by the presence in the body of micro-organisms, also termed microbes, germs, or bacteria. These micro-organisms are universal, and can enter the body by means of a wound or abrasion, and in a surgical case the great thing to be feared is the infecting of the wound with disease by introducing into it one of the pathogenic—*i.e.*, capable of producing disease—micro-organisms.

The treatment of most surgical cases is carried out by the application of two great principles—**cleanliness** and **rest.** Operations are only likely to be successful if these two principles are strictly adhered to, and many operations are unjustifiable unless the surgeon is absolutely certain that he can keep his wounds clean. The surgeon cannot cure a patient or heal a wound; that must be done by a natural process. He can only place his patient in the best possible position for being cured, and it is the nurse's duty to see that this position is maintained.

Forty years ago operating was done in an entirely different way to what it is now. Nothing was known about micro-organisms as the cause of disease and suppuration, and no precautions were taken against their presence in an operation wound. The present elaborate system of aseptic and antiseptic operating is due to the recognition of the all-important part played by bacteria in causing suppuration. The former surgeon expected his wounds to suppurate, and thought it was part of the healing process; and looked at in the light of modern thought it is surprising that any of his wounds ever healed cleanly. Instead of modern sterilized garments, one coat was used for all operations, and the more a surgeon had operated in a coat without washing it the more proud he was of it. All the swabbing of the wound was done with one sponge, which was used for all patients, irrespective of the nature of the disease, and so infection was carried from patient to patient. Dressings consisted of lint or cotton-wool kept in a drawer, or in some methods of treatment they were not used at all, the wound being exposed to the air, and frequently bathed with water. Suppuration, gangrene, and

1—2

sloughing of wounds was common, and 'Luck' was a recognised factor in surgical work.

The modern method of operating has grown out of an article written by Lord Lister in the *Lancet* of 1867. In this article he proved that suppuration was due to the presence in the wound of micro-organisms, and if they could be banished or killed suppuration would not occur. He laid down rules, which had for their object the elimination of the bacteria, to be observed before, during, and after all operations.

These rules of Lister have, of course, been much altered and modified, but the principles he laid down are still adhered to, and he is rightly considered to be the pioneer of modern surgery.

Surgical cleanliness is much more than ordinary personal cleanliness. It is a cleanliness that is never found outside surgery. This cleanliness aims at the elimination of all micro-organisms, and many operations in surgery are only possible if a guarantee against infection can be given.

Micro-organisms, which are the lowest forms of vegetable life, are, of course, invisible, except when highly magnified by the microscope, lenses enlarging about a thousand times being used. The ordinary clean hand contains about a hundred varieties, not all of which, however, are harmful to man. They are of different shapes and sizes, by which they can be recognised and classified.

The most important being the cocci, the bacilli, and the spirilla.

The cocci are small, round bodies, which grow very readily on dead material, such as gelatine, and are the chief pus-forming (pyogenic) organisms.

The best known are the *Staphylococcus pyogenes*, the cause of boils, and the *Streptococcus pyogenes*, the organism present in cellulitis. They multiply by dividing into two, and are resistant to adverse circumstances, remaining alive for weeks on dressings.

The bacilli are rod-shaped organisms, and beside multiplying by division or fission, under certain circumstances they form spores. These spores appear in the body of the bacillus when the food-supply is scarce, and are the means by which the bacilli live through adverse conditions. The spores resemble the cocci, but are very much harder to kill, and under favourable circumstances they develop into adult bacilli.

The bacilli which form spores are more dangerous than the non-sporing forms, as they are much harder to kill. Examples of these bacilli are tetanus and anthrax.

The spirilla are curved organisms, and are of little importance in surgery. The best known is the spirillum of relapsing fever.

The micro-organisms cause various diseases, some being very fatal, such as lock-jaw, due to the *Bacillus tetanus*, and others trifling complaints, such as boils; and it is the presence of these micro-organisms in a wound that prevent it from healing.

Methods of Infection by Micro-organisms.

1. **Air.**—Infection can take place in a wound through the air, but this is a comparatively rare source of infection. In the early days of antisepsis the presence of micro-organisms in the air was thought

to be all-important, and many precautions, such as the carbolic spray, were taken against this path of entry into wounds. Practical experience has now proved the harmlessness of air free from dust. The micro-organisms will not leave a surface and pass into the air, especially if it be damp; they can only be conveyed on particles of dirt. Dust-free air being also bacteria-free air, some organisms—for example, tetanus—are actually destroyed by exposure to air and sunshine. In fact, sunshine is one of the most important natural antiseptics. The air in a modern operating-theatre is kept germ-free by an elaborate system of ventilation and purification.

At the London Hospital the air is pumped in from the garden, and washed by passing it through water. It is then filtered through seventy-two screens of cotton-wool, and after being warmed by a steam radiator, enters the theatre by a large shaft, being practically sterile.

Before operating, steam is blown all over the theatre, so that the surface is damp, and this prevents any dust which may have accumulated from being blown about, and so serving as a vehicle for micro-organisms.

In operating in private houses care should be taken that the room is dust-free, and that as little disturbance as possible takes place on the day of operation.

2. **Instruments.**—At the present time all surgical instruments are made of metal, so that they can be sterilized by boiling. All living organisms of importance in disease are killed by boiling for ten minutes, and this sterilization must be done before every operation, however trivial.

The instruments are put into boiling water, to which

1 per cent. of bicarbonate of soda has been added, and are boiled for ten minutes. If during an operation a fresh instrument is required, it is sufficient to boil it for three minutes, unless it is known to have been recently used for a case of anthrax, or for some other disease in which the bacteria form spores, spores being more difficult to kill than the bacteria.

The instruments are removed from the sterilizer in the special tray, or with freshly-boiled forceps, and placed in 1 in 40 carbolic solution. They should not be touched by the hands of anyone except the operator.

Knives should only be boiled for thirty seconds, as the more prolonged boiling blunts their edges. When placed in a sterilizer, they should be guarded from bumping against the bottom by placing them on a piece of lint. After boiling, they should be kept in a solution of lysol 1, rectified spirit 3. When wanted, they are removed by sterilized forceps and placed in the instrument-tray.

After the operation, the instruments should be cleaned in hot water with a nail-brush, then sterilized. After sterilizing, they are washed in water to remove the soda, and placed in methylated spirit, and then dried and put away.

3. **Ligatures and Sutures.**—All these can convey micro-organisms into a wound, and as they are left in the wound it is of the utmost importance that they should be sterile.

Ligatures and sutures are made from silk, silkworm gut, catgut, kangaroo tendons, and horsehair, and they each are sterilized in a special manner.

Silk is used in various sizes, and is purchased in hanks of about 15 yards.

To sterilize it, unwind the first part of the hank and wrap it loosely in a piece of gauze. Boil it in plain water for fifteen minutes, and remove it from the sterilizer with sterilized forceps. Place it in rectified spirit. Wind it directly from the spirit on to a glass reel, and then again boil for ten minutes. Keep the reel in a glass vessel, and cover with absolute alcohol.

At the time of the operation place it by means of sterilized forceps into carbolic lotion (1 in 60). After each operation the silk should be reboiled, but if this is done often it becomes easily breakable.

Silkworm Gut.—To sterilize this do it up into small bundles of ten strands, and boil for fifteen minutes. Remove it with forceps from the sterilizer, and keep it in 1 in 20 carbolic lotion. During the operation place it in 1 in 60 carbolic lotion, and any strands left over should be resterilized.

Catgut is more difficult to sterilize, but satisfactory results are obtained by either of the following methods:

Method (*a*).—1. Soak the catgut in ether for twenty-four hours to remove all the fat.

2. Soak in biniodide of mercury and spirit 1 per cent. solution for twenty-four hours.

3. Change the lotion, and let it soak for another forty-eight hours.

4. Keep in a solution of carbolic acid and spirit (1 in 40), changing this several times during a fortnight.

5. At the time of operation place in 1 in 60 carbolic lotion.

Of course, in this as in all processes of sterilization, the catgut should only be touched by sterilized forceps.

Method (*b*).—This is known as the Japanese method.

1. Soak the catgut for twenty-four hours in a 5 per cent. solution of the fluid extract of Quebracho.

2. Wash for three or four hours under a tap of running water.

3. Soak it in a 4 per cent. solution of formaline for forty-eight hours.

4. Wash in running water for twenty-four hours.

5. Boil in water for ten minutes.

6. Keep in carbolic lotion (1 in 20).

7. At the time of operation place in carbolic lotion (1 in 60).

This method gives a very firm, pliant ligature, which is not very quickly absorbed.

Kangaroo tendon is used chiefly in hernia operations, and for suturing displaced kidneys into position. It is sterilized in the same way as catgut, Method (*a*) being used.

Horsehair is sterilized in the same way as silkworm gut, by boiling. It should be prepared as it is wanted. It is a suture material that has fallen into disrepute, but it is still used to suture wounds in the face and neck where little scar is desired, as it is thinner than ordinary silkworm gut.

4. **Sponges.**—These are largely used in abdominal work, and are either flat or round. They cannot be sterilized by moist heat, as they are composed of an animal matter, and become pulpy on prolonged boiling.

Before actually sterilizing them they must be thoroughly washed free from all sand and calcareous particles, which they often contain. To do this they are washed in water which is changed fifty or sixty times, and every part of the sponge is carefully felt

and inspected till the minutest grain of sand has been discovered and removed. They are now soaked for three weeks in carbolic lotion (1 in 20), and are then ready for use. At the time of operation they are wrung out of hot carbolic lotion (1 in 60).

Sponges that have been used for 'clean' cases—that is, cases in which they are not soiled with pus or fæces—may be used again, but they must be re-sterilized.

They are first soaked for twenty-four hours in a 2 per cent. solution of soda, and then washed in plain sterilized water which is changed many times. When quite clean, they are left to soak in 1 in 20 carbolic lotion for three weeks, and are then again ready for use.

Sponges that are soiled with pus or fæces should never be used again for surgical work.

5. **Bowls, Trays, etc.**—These should all be boiled for ten minutes before use.

If it is impossible to boil them, they must be thoroughly cleaned, and then boiling water poured over them.

6. **Water.**—This in hospital is sterilized by boiling under pressure at 240° F. If this is not possible, freshly-boiled water should be used for lotions; but water drawn from the tap is little likely to contain harmful bacteria, and may be used in cases of emergency or where boiled water is not obtainable.

7. **Coats, Towels, Dressings, Swabs, etc.**—These are packed in tins, and sterilized by heating to 280° F. in a dry sterilizer for twenty minutes. After being sterilized, they should be sealed down with paper slips, and not opened till the time of operation.

When a tin has been once opened any of the dressing left over should be resterilized.

If it is impossible to sterilize the towels, clean ones fresh from the laundry should be used wrung out in 1 in 40 carbolic lotion, and many surgeons prefer their sterilized towels treated in the same way.

8. **Mackintoshes.** — The mackintoshes should always be covered with sterilized towels at the time of operation, as it is impossible to boil them. They should be scrubbed thoroughly on both sides with soft soap and hot water, to which 1 dram of lysol to the pint of water may be added, then with 1 in 40 carbolic lotion. After this they should be wiped dry with a sterile towel, and dried before the fire. They should then be rolled up and put away ready for use.

9. **Hands.**—These are undoubtedly the most important factors in conveying infection to wounds. It is impossible to get the hands absolutely sterile, but for practical purposes the following routine will suffice:

The nails must be kept very short, and should never be scraped with scissors or other instruments. Careful scrubbing with a nail-brush will remove all the dirt, and if they are scraped out with scissors a space will be left in which dirt quickly accumulates. Rings must not be worn in surgical work. Before an operation or dressing, the hands and arms up to the elbows must be well washed in hot water, to which a little lysol has been added. Special care must be taken to wash the nails and between the fingers. Plenty of soap, too, must be used, and the water changed at least three times, or better still they should be washed under a running tap. The nail-brush used should be sterilized

and kept in lysol lotion. After this thorough washing, the hands should be rinsed in biniodide lotion (1 in 1,000), and then either wiped with a sterilized towel or allowed to dry.

Many micro-organisms will still remain in the deeper parts of the skin, and these will be washed out by the sweat during an operation. To remove these the hands should be repeatedly rinsed in biniodide or carbolic lotion during the operation. After once sterilizing the hands for an operation, nothing which is not sterilized should be touched, but a nurse's duties during an operation being not usually entirely connected with the wound, it is almost impossible to carry out this rule, but after touching anything septic the hands should be at once dipped in lotion or re-washed.

It is important to recognise the fact that merely dipping the hands in even strong lotion is not sufficient to sterilize them. By far the most important part is the careful washing with soap and water. Lotions are only secondary to this.

Should the nurse have a cut on her hands, especially if it be septic, she is debarred from attending any operation.

Some surgeons now use, and make their assistants use, indiarubber gloves, which can be sterilized by boiling. If these are used, it is just as important to thoroughly wash the hands before they are put on, and not to trust entirely to them; and if for some reason they are discarded during the operation, the hands must be again washed, as the gloves cause sweating, which washes out the micro-organisms in the sweat-glands. It is well to put the gloves on while the hands are still soapy.

The second great principle in the treatment of a surgical case is **rest,** or, better, physiological rest to the wounded part—that is, the functions that the part has to perform are reduced to a minimum. Thus the stomach is kept at rest by giving it no food to digest, and a knee-joint by keeping the patient's leg on a splint, so that the knee cannot be bent. Rest includes rest of the whole body by keeping the patient in bed, and rest applied to the part that is chiefly concerned, and in the case of the limbs this is carried out by means of splints, bandages, and other mechanical appliances. The ordering of these is in the hands of the surgeon, but their application is frequently left in the hands of the nurse, and in all cases the nurse should see that the splints are kept as originally applied by slight adjustment from time to time. It is only in cases of great emergency that they should be removed, and the facts reported to the surgeon at the earliest possible opportunity.

The importance of rest is particularly seen in the treatment of fractures. If the limb be not kept still, the ends of the bone will constantly rub against one another, so will be constantly irritated, and union will not take place. After the surgeon has put a fracture in the best possible position for union, that position must be maintained by the nurse.

It will be recognised, however, that in our present condition of civilization surgical rest cannot be carried out in all cases as absolutely as one would like. There are business and social complications that arise, and one is reminded that surgery and the best methods of treatment are not always considered by the patient to be of the first importance.

A patient with a fractured tibia and fibula who has

large business connections which are going to ruin whilst he lies in bed will not consent to rest. Often he will insist on getting about and attending to his affairs, and if by threats of the consequences he is compelled to stay at home, the chances of the fracture doing well will not be many. Mental rest is often as important as physical, and this to a large extent depends upon the tactfulness of the nurse. At times patients will insist upon doing what the nurse considers wrong, and directly against the doctor's order; and although in a large number of cases they can be guided against their will, yet in others the nurse must give way tactfully so as to still retain the confidence of the patient.

To prepare Catgut & Kangaroo Tendon
wind on Sterile Glass reels & place
in sterile jar in 1% watery Solution
of Iodine & Pot. Iodide.
Keep it in 8 days before using.
wash in 1-20 Carbolic to
whiten.

CHAPTER II

INFLAMMATION

Definition — Causes — Pathology — Clinical signs — Terminations — Treatment — Splints — Position — Heat — Cold — Bleeding — Chronic inflammation—Counter irritation—Pressure—Massage.

Definition.—The series of changes following an injury that occurs in living tissue, provided that injury is not sufficient to kill the tissue, or, more simply, the reaction of tissue to injury.

Injury may be due to many things, such as :

1. Blows and foreign bodies.
2. Chemicals—*e.g.*, sulphuric acid.
3. Electricity.
4. Burns and scalds.
5. Micro-organisms.

It is most important to understand thoroughly the relationship of these last to inflammation and suppuration, a process that has to be carefully distinguished from inflammation. Suppuration is a complication of inflammation, and is always due to the presence of certain micro-organisms called the pyogenic (pus-forming) bacteria, while inflammation often occurs without bacteria being present.

After an injury to the knee due to a strain, the knee-joint becomes inflamed, but no micro-organisms are present, and a foreign body in the conjunctival sac of

the eye will cause acute inflammation, but not suppuration.

At the same time, it must be fully recognised that inflammation may be due to micro-organisms, and yet the process not go on to suppuration. Thus erysipelas, an acute inflammation of the skin, is due to a micro-organism, but suppuration rarely occurs, and acute inflammation of joints during the course of septic pyæmia may subside without suppuration occurring or the joint becoming disorganized.

A wound, if looked at two days after operation, will always show signs of inflammation, even if it heals absolutely aseptically, as the part has been injured, and inflammation is the reaction of tissue to injury

The changes that occur in a part that has become inflamed have been carefully studied under the microscope. The web of the foot of a living frog is fastened under the microscope, and the circulation of the blood in the bloodvessels and their contents can be seen. The skin is then injured by touching it with some acid, and the changes that occur are then observed. The same changes occur in the human body, and are recognised by various clinical (bedside) signs as being caused by inflammation.

When the part is injured, there is first a momentary contraction of the small arteries, veins, and capillaries of the part, due to the stimulus of the injury. This is followed by the bloodvessels becoming gradually dilated, and this dilatation will continue as long as the inflammation lasts, or until the dilatation is so extreme that the vessel bursts.

At the same time that dilatation is occurring the blood-stream becomes quicker and quicker, so that the blood passes more and more quickly through the capil-

laries, and there is a condition of dilated vessels with quickened flow.

Corresponding with these changes are the clinical signs of **redness** and increased **heat.** The blood itself in the inflamed part is not hotter than elsewhere, but more blood passes through it in a given time, and so the part feels hotter.

As the inflammation gets more and more severe, the blood-stream gets slower and slower, and there is dilatation with diminished flow, causing the inflamed part to look blue and congested. Finally, the blood-stream will stop, and there is dilatation of the vessels with **stasis.**

If inflammation is still more severe, the bloodvessels will burst, and the blood be extravasated into the tissues, and death of the part may occur.

Whilst these changes are occurring in the bloodvessels and the blood-stream, there is a leakage going on through the vessel walls. First, the fluid part of the blood, the serum, or plasma, will ooze through the vessel walls into the surrounding tissues, causing a swelling or œdema of the part, and this will cause a stretching of the skin, and pressure on the nerves, giving rise to pain. Two more clinical signs will therefore be added —**swelling** and **pain.**

The amount of pain will vary with the denseness of the tissue. The more dense, the less it can swell, and the more pain the patient will suffer. For example, in inflammation of the eyelid there is much swelling, but little pain, but if a bone becomes inflamed the pain is very severe, and no appreciable swelling of the bone can be made out.

The serum which has exuded through the vessel walls is known as inflammatory lymph, and must be distin-

guished from the normal lymph that occurs in the lymphatics; it is only found when a part is inflamed.

After the inflammatory lymph there follows a migration of the white cells or corpuscles of the blood. The solid constituents of the blood consist of red and white cells, there being 5,000,000 red cells and 10,000 white cells in a cubic millimetre of blood.

The white cells first pass to the sides of the blood-vessels, and then slip through their walls without damaging them, a process which is known as diapedesis. Once free from the bloodvessels, they wander about the inflamed part, and are known as phagocytes.

In very acute inflammations, such as pneumonia, the red cells also leave the vessels, or the vessels burst, and the inflammation is then spoken of as hæmorrhagic.

Whilst these changes have been occurring in the bloodvessels and blood-stream, the cells of the inflamed part have been actively dividing, so that round the dilated vessels the part is crowded with cells which are partly phagocytes and partly newly-formed cells from the tissues.

Inflammation has now reached its height, and the following conditions are present:

1. Dilated and ruptured bloodvessels.
2. Slow blood-stream, or complete stasis in the centre of the inflamed part, with quickened blood-stream at the edges.
3. Inflammatory lymph, white and red blood-cells outside the vessels.
4. The original cells of the part actively dividing.

Corresponding with these conditions there are the clinical signs of **redness**, **swelling**, **heat**, and **pain**.

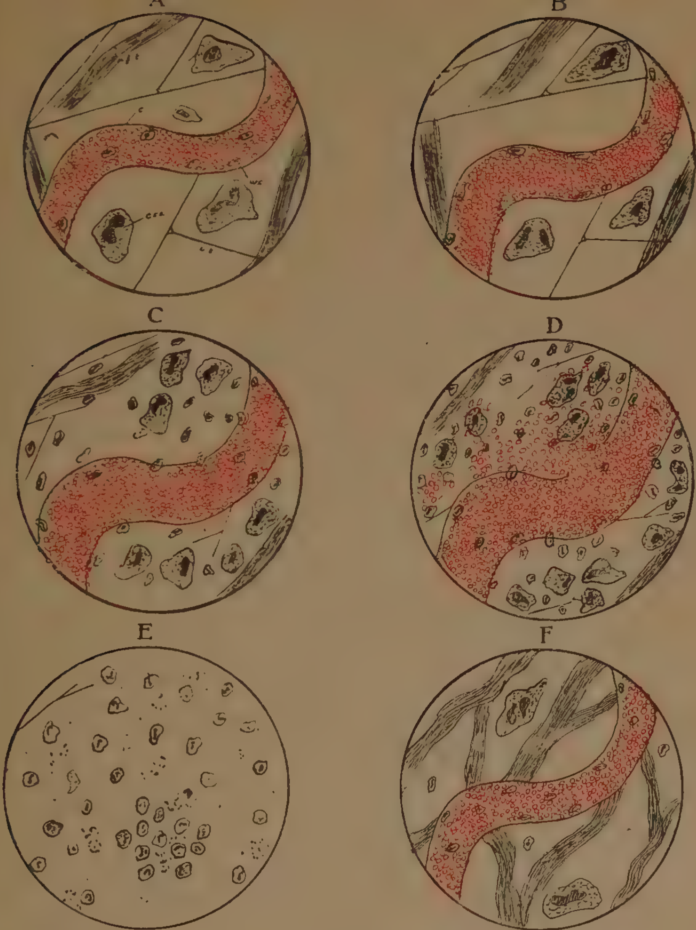


DIAGRAM OF CHANGES IN THE BLOODVESSELS AND TISSUES DUE TO INFLAMMATION.

A. Normal capillary bloodvessel and connective tissue: *ft*, fibrous tissue; *ctc*, connective tissue cell; *wc*, white blood corpuscle; *c*, capillary; *ct*, elastic tissue.
B. First change. Dilatation and congestion of bloodvessel; the white cells arranged along the sides of the vessel wall; exudation of serum.
C. Second change. Bloodvessel dilated and congested; exudation of white cells (phagocytes); multiplication of fixed connective tissue cells; fibrous and elastic tissue indistinct.
D. Third change. Rupture of the congested vessel and escape of red corpuscles; multiplication of connective tissue cells; normal tissue very indistinct.
E. Pus. Breaking down of the whole tissue, due to the presence of micro organisms; suppuration.
F. Chronic inflammation. Bloodvessel small; great increase of fibrous tissue.

To face page 18.

To these four signs must be added a fifth—**loss of function.** A part that is inflamed cannot perform its work: an inflamed stomach cannot digest food; an inflamed knee-joint cannot be moved.

General Symptoms.—Besides these local signs of inflammation, the patient will suffer from certain general symptoms due to the absorption of some of the constituents of the inflammatory lymph. There will be a slight rise of temperature (99° F. to 101° F.), headache, and a general feeling of discomfort with loss of appetite.

The condition is known as aseptic traumatic fever, and will pass off in forty-eight hours, when the production of the inflammatory lymph ceases, always supposing the inflammation is not due to the presence of micro-organisms, for if so the condition will pass into that of septic traumatic fever.

Having traced the changes in the tissues due to inflammation, the next points to be considered are the terminations of inflammations.

1. **Resolution,** or the return of the tissue to its original condition. This takes place as follows:

Some of the white cells of the part die and disintegrate, whilst others return to the blood-stream, either directly or by means of the lymphatic system.

The inflammatory lymph is absorbed either by the blood or the lymphatic stream.

Red cells always die and disintegrate, and their colouring matter forms the pigment that is seen in scars and parts that have been inflamed.

The new cells replace the old cells that have been killed by the inflammation, or the injury, and resolution is complete. It is impossible to tell that the part has been inflamed.

2. **Inflammation becomes Chronic.**—This implies a cause, which goes on acting for a long time, such as the presence of micro-organisms, or some poison, such as alcohol, or constant slight injuries. The bloodvessels remain dilated, inflammatory lymph is constantly poured out, new cells are always being formed, and the part remains swollen, hot, and painful, and its function is impaired. The new cells form a mass of new fibrous tissue, which interferes still more with the function, and the condition passes into that of fibrous thickening.

3. **Suppuration may Occur.**—This is always due to the presence of the pyogenic micro-organisms. These organisms, by their growth in the tissues, cause death of the white cells and of the cells of the part in large numbers, and at the same time liquefy the tissue in a manner similar to the digestion of food in the stomach, so that the inflamed area becomes filled with a liquid in which are numerous dead and dying cells. This liquid is **pus,** and suppuration is said to have occurred. The liquefaction of the tissues and formation of pus will go on as long as the micro-organisms are alive, or until the abscess has reached a free surface, when it will burst and discharge its contents. The signs of an abscess will be those of **inflammation, redness, swelling, heat,** and **pain,** to which must be added **fluctuation**—*i.e.*, the feeling of fluid in the part. This feeling can be felt to perfection by pressing with the hands on a partially-filled water-pillow.

4. **Ulceration.**—This is suppuration occurring on a free surface, either skin or mucous membrane.

5. **Death of the Part, or Gangrene,** may occur owing to the severity of the inflammation, as is seen in frost-bites or in boils. The part that dies is known as a slough if the soft tissues are concerned, or as necrosis if it is bone that dies, and it must be removed before healing can occur.

Treatment of Inflammation.—The object of treatment is to promote resolution quickly, so that the part returns to its original condition, and it should be conducted along the following lines :

1. **Remove the Cause.**—Thus a foreign body should be immediately removed from the eye; an irritant chemical neutralized and washed out of the stomach; micro-organisms should be killed by antiseptics.

2. **Rest to the Inflamed Part.**—Limbs should be kept on splints, and if the lower extremities are inflamed, the patient kept in bed. Joints should be kept immobile in splints or plaster of Paris. The stomach should be kept at rest by giving it very little food to digest.

Splints.—These are made of various materials, chiefly wood, metal, gutta-percha, and poroplastic felt, and are of various shapes, as they have to be used for all parts of the body. Many splints have received the names of the surgeons who have invented them, and a list will be found below of the most important of these splints, and the purposes for which they are used.

Metal and wooden splints usually require padding before they are applied, and the padding-wool made

especially for this purpose is the best material to use. A mixture of cotton-wool and tow may also be used, or plain cotton-wool if nothing else is at hand, but this is apt to collect into lumps, besides being expensive.

The padding should be sterilized before being used, and must be evenly spread over the splint, special care being taken to cover the sharp edges.

The best material for covering splints is old, soft linen, or, in want of this, unbleached calico, and it should be secured over the padding by stitching, or, in cases where the splint has to be prepared in a hurry, with strips of strapping.

If it is anticipated that there will be any discharge from a wound of the part to which the splint is applied, or if moist or greasy dressings are applied, the splint should be covered with jaconet, as this will prevent the discharge soaking into the padding, and it can be easily cleaned.

Splints which are used for the lower extremities of young children should also be protected by mackintosh to prevent the soaking in of the urine.

If the splint is to be applied to a part where much perspiration is common, such as the foot, a piece of boric acid lint should be placed between the splint and the part, or the splint should be covered with boric acid powder.

Splints are held in position by bandages or strapping, and after their application the nurse should watch the part below the bandages for any discoloration or swelling which may occur, as this will often indicate excessive pressure, and the surgeon must be at once warned.

In applying back splints to the leg and foot, it is

well to place a heel-pad under the tendo Achilles, so that the heel itself only rests lightly on the splint, otherwise a pressure-sore may occur, which will be very troublesome to heal.

After use, a wooden splint should be cleaned by rubbing it well with a piece of tow soaked in turpentine, and then scrubbing it vigorously with hot water and plenty of soap and soda. Finally it is washed in 1 in 20 carbolic lotion, dried, and repadded.

All padding and covering materials are burnt.

Metal splints are cleaned after use by scrubbing with turpentine, washing with soap and water, and sponging with 1 in 20 carbolic lotion.

Gutta-percha and poroplastic felt splints are usually moulded on to the part that requires splinting.

A pattern in stout paper is made, the paper being laid on the part and cut to the required shape, notches being cut where it gapes on passing concavities. From this pattern the splint is cut in general outline.

Gutta-percha is softened in hot water, care being taken not to make it sticky by leaving it in too long.

The limb must be thoroughly oiled, and the gutta-percha carefully moulded on to it and secured with a bandage. As it takes some time to harden, there is no hurry, and when it has acquired some degree of firmness it can be removed and hardening hastened by placing it in cold water. It should be lined, and have holes punched in it to allow the evaporation of the sweat.

Poroplastic felt may be softened in hot water, but heating it in the oven gives better results. It hardens quickly, and so must be moulded rapidly. The limb is covered with a flannel bandage, and the shaped

material quickly applied and firmly secured with a bandage.

It may be lined, and holes should be cut in it for the same reason as the gutta-percha splints.

Poroplastic felt is largely used by instrument-makers

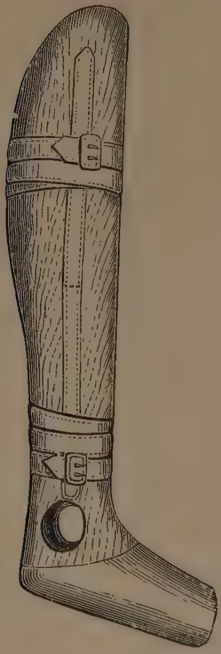


FIG. 1.—CLINE'S SPLINT.

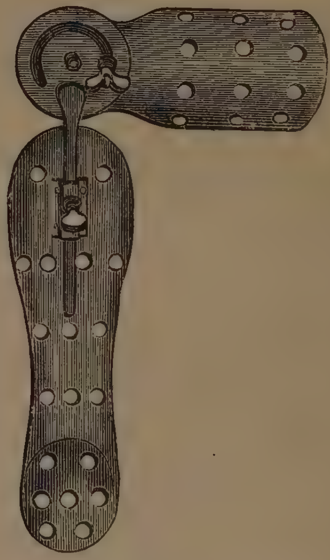


FIG. 2.—MASON'S ADJUSTABLE SPLINT.

in the manufacture of jackets for the treatment of disease and deformity of the spine.

The methods of making splints of plaster of Paris and gum and chalk will be found in the chapter on Fractures.

List of Splints and the Purposes for which they are Chiefly Used.

Splint.	*Use.*
Gallows' splint	Fractured femur : infant.
Box splint	Fractured femur in children ; hip-joint disease ; osteotomy of femur.
Liston's long splint	Fractured femur.
McIntyre's splint	Fractured femur or fractured tibia and fibula.
Hodgen's splint	Fractured femur.
Nathan Smith's splint ..	Fractured femur.
Howse splint	Excision of knee.
Neville's splint	Fractured tibia and fibula.
Cline's splint	Fractured tibia and fibula.
Roughton or Sharpe's splint ..	Pott's fracture.
Upper Extremity.	
Erichson's shoulder-cap ..	Fractured head of humerus.
Middledorf's triangle ..	Fractured humerus.
Mason's adjustable splints ..	Fractures of arm or forearm ; excision of elbow.
Carr's splint	Colles' fracture.

Various.—Interrupted splints consist of two parts joined together by metal bars. The interruption should come opposite any wound that may be present, to facilitate dressing. Gooch's kettle-holder splinting consists of narrow pieces of wooden splinting held together by being glued to strong, flexible cloth, generally so-called American cloth. Talipes splints are made of strips of bendable metal, lightly padded and covered with chamois leather.

Thomas's knee and hip splints are metal splints covered with leather, and are used in the treatment of tubercular diseases of the hip and knee. Thomas's double splint is made of the same materials, and is used in the treatment of disease of the spine.

Gutta-percha splints are especially useful in fractures of the hand and foot and for fractures of the lower jaw.

3. **Position.**—The inflamed part should be kept elevated, so as to favour the return of blood from it.

In the case of the upper extremity the part is kept elevated by securing the hand above the head by a bandage. A splint is usually applied first, and the bandage secured to any convenient hook above the bed.

The lower extremity is elevated by means of an

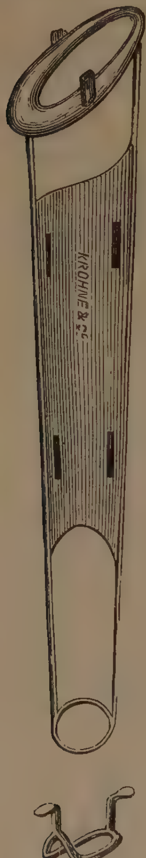


FIG. 3.—THOMAS'S KNEE SPLINT.

FIG. 4.—THOMAS'S DOUBLE HIP SPLINT.

inclined plane. This consists of a piece of board suitably covered, and supported at an elevation of 45

degrees with the bed. In cases of emergency an inverted chair can be made to do duty for the more orthodox apparatus used in hospital.

4. **Cold.**—This may be applied during the early stages of inflammation, as it causes contraction of the bloodvessels and limits the effusion of lymph, but if applied too long may cause gangrene of the part, as in frost-bite. It should not be used in young infants or old people.

Methods of Applying—(1) **Ice-bag.**—A bag made of india-rubber should be filled with broken ice, to which common salt may be added. It should be suspended so as to just rest on the inflamed part, and a piece of lint should be placed under it, which should be changed as it gets damp.

(2) **Leiter's Tubes.**—These are tubes of soft metal which can be moulded to the part, and cold or iced water can be kept flowing through them. A piece of lint should be placed between the tubing and the part, and the application carefully watched, as the tubes are very efficient in keeping up the cold. It is as well not to leave them on for more than two hours at a time, on account of the great depression of vitality that results.

(3) **Evaporating Lead Lotion.**—A piece of lint is soaked in the lotion and laid on the inflamed area. The part must be exposed to the air, and the lint frequently dipped in the lotion.

In applying cold, it is essential that the application should be continuous for the time being, otherwise the inflammation will be increased by the constant changes of temperature.

5. **Heat.**—This will increase the circulation of the part so that the products of inflammation can be rapidly carried off, and at the same time the tension of the inflamed area is relieved, and so the pain becomes less.

If suppuration is inevitable, the warmth will cause more rapid breaking down of the tissues and increased activity of the micro-organisms ; pus will be rapidly formed, and can then be evacuated, and sloughs will quickly separate.

6. **Methods of Application.**—(1) **Fomentations** are made by pouring boiling water on a piece of flannel or lint, which is then wrung dry and quickly applied to the skin. Outside it, and overlapping it in all directions, is placed a piece of jaconet, and outside this again some cotton-wool, the whole being secured by a bandage. It cools readily, but may be kept hot for a longer time if an indiarubber hot-water bottle containing boiling water be laid over the part outside the cotton-wool.

The water with which the fomentations are made can contain drugs in solution, such as carbolic acid, perchloride of mercury, or lysol, the fomentation then being antiseptic. The strengths used commonly are carbolic acid 1 in 40 to 1 in 80 ; perchloride of mercury, 1 in 1,000 to 1 in 5,000 ; lysol, ½ dram to 1 dram to the pint.

Boracic fomentations are made with lint which is impregnated with boracic acid.

Carbolic Fomentations or Carbolic Compresses should not be used for the extremities, otherwise gangrene of the fingers or toes may result.

Perchloride of Mercury Fomentations are apt to cause inflammation of the hair follicles of the skin, and small pustules appear in the skin round them.

If drugs such as opium or belladonna are ordered to be applied with fomentations, the tincture of the drug should first be painted on the part, and then the fomentation applied over it.

(2) **Poultices** are seldom used now in surgery, their place being taken by the more aseptic fomentations, but they are useful if heat is to be applied to an unbroken surface, and the constant attention necessary for fomentations cannot be given. They retain the heat longer than fomentations, and so need be changed less frequently. Great care must be taken to avoid scalding, or the skin will be unfit for surgical procedures. Linseed-meal is what is usually employed, and the poultice must not be too heavy—about four tablespoonfuls of linseed-meal to a pint of water—and it must be as hot as possible, the water boiling and the material on which the poultice is spread previously heated.

(3) **Baths.**—Baths are used in the treatment of inflammation as a means of applying warmth and antiseptics to the extremities. They consist of hot water, to which is added lysol, ½ dram to a pint; perchloride of mercury, 1 in 5,000, or carbolic, 1 in 80, and are chiefly used for treatment of a spreading inflammation due to the *Streptococcus pyogenes*.

The best form of bath is a rectangular tin trough holding about 8 pints of water (sufficient to cover the part), one end of which is sloping and hollowed, to allow the arm to rest comfortably in it.

If the hand is to be kept in a bath, the patient is most comfortable sitting in a chair, with the bath on another chair or low table near him.

It is important to see that the part is as elevated as possible for comfort, and that the arm does not press unduly upon the edge of the bath, otherwise the venous return is obstructed and the hand becomes congested and œdematous—two things it is most important to avoid. A pad placed under the arm keeps it off the edge of the bath, and distributes the pressure evenly.

The bath should be covered with a piece of mackintosh, and over this a flannel or woollen cover, so that the heat is retained; and the water must never be allowed to get cool, fresh hot lotion being frequently added.

The bath encourages free bleeding after incisions have been made into the inflamed area, and this is beneficial if kept within limits, but the nurse must watch to see that the bleeding is not excessive. The patient will often be quite unconscious that hæmorrhage is occurring, and the loss of blood may be serious or even fatal, without his feeling anything more than a sensation of extreme drowsiness and weakness. Should bleeding be excessive, the limb must be at once removed from the bath, and a very hot fomentation applied with firm bandaging, and the surgeon sent for.

When fresh water is added to the bath the limb must always be taken out first, otherwise the patient may be scalded.

7. **Blood-letting.**—By blood-letting, the local congestion is diminished, and this can be brought about in two ways: (1) General; (2) local blood-letting.

The effect of general blood-letting is to lessen the

vigour of the heart's action, and consequently to reduce the force and rapidity with which the blood is sent into an inflamed part. At one time an almost necessary adjunct to all forms of treatment and used in all diseases, this method of reducing blood-pressure is now seldom used in surgery.

For general blood-letting, the veins at the bend of the elbow of the left arm are chosen. The skin is carefully cleaned as for an operation, a piece of bandage is bound round the arm above the elbow so as to obstruct the veins and not the arteries, and the swollen vein is then opened with a scalpel. The blood should be received into a graduated vessel, so that the exact quantity drawn off can be estimated. The bandage is then removed from the upper arm, the minute incision closed with a stitch, and an antiseptic dressing firmly applied. A pint to a pint and a half is usually the quantity removed.

The forms of local blood-letting in acute inflammation consist of leeching, scarification, and free incision.

Leeching.—The amount a leech will usually extract is 1½ drams, and once it has sucked its fill, it usually drops off. If it be desired to continue its action, bleeding can be promoted by the application of warm fomentations.

In applying a leech, care should be taken to confine its movements within the area in which it is required to act (that area having been previously thoroughly cleansed), and if it does not quickly take hold, the part can be pricked and a little blood drawn, or it can be rubbed with a little milk. If the leech does not drop off when it is full, the application of a little salt and water will produce that effect.

When it is desired to stop bleeding, the application of pressure is usually sufficient, but there may be some trouble in arresting hæmorrhage.

It may be necessary to apply a styptic, such as perchloride of iron or adrenalin, but generally it is sufficient to pinch up the skin round the leech-bite, dry it thoroughly, and paint it over with collodion.

Leeches should not be applied to parts where the skin is loose and where pressure cannot be applied—for instance, to the eyelids or scrotum ; and also, if possible, leeches should be used in the morning, and not at night, so that if bleeding goes on it can be readily detected.

Leeches should not be used on parts where an operation is likely to be performed, as it will be impossible to thoroughly cleanse the skin soon after the application.

Wet and dry cupping are seldom used in surgery, and for methods of performing this little operation the nurse is referred to text-books on general or medical nursing.

Blood-letting in surgery is usually accomplished by a free incision into the part ; bleeding is encouraged by the application of fomentations, and the wound left to heal by granulation.

General Treatment.—As regards the treatment of the general condition, the indications are to keep up the strength of the patient, to dilute the poison in the blood, and to limit any special symptoms which may arise.

The excretory organs should be kept active by the administration of saline purges to empty the bowels, and the giving of diuretics (drugs causing increased

excretion of urine) to promote the healthy action of the kidneys.

As regards the food during the acute stages of inflammation, it must consist essentially of milk and fluid preparations of meat (the patient can digest nothing else, owing to the general constitutional condition). Stimulants are not usually necessary or desirable, but in debilitated and old people are often extremely beneficial.

Treatment of Chronic Inflammation.—If the acute inflammation passes into a chronic condition, other methods than the above can be adopted.

Counter-Irritation.—The mode of action of this is not quite understood. The principle is to cause a superficial inflammation of the skin over the inflamed organ. Thus, the skin of the loin can be inflamed with benefit to an inflamed kidney beneath.

Methods.—The rubbing in of various liniments that have a rubefacient effect—*e.g.*, liniment. camph. co. These liniments must not be too vigorously used, especially in young children, otherwise blistering or even sloughing of the skin may result.

Blisters.—Blisters are usually produced by painting the part with blistering fluid (liquor epispasticus), and not with blistering plasters (emplastrum cantharides), which cause more pain.

The part to be blistered should be outlined with a ring of olive oil and the fluid painted on, care being taken not to use excess or to touch any other part with the liquid.

The blister will usually rise in from six to twelve

hours, and a fomentation placed over it will naturally assist the process.

After the blister has risen, it is not, as a rule, necessary to puncture it, but if the tension is causing much pain to the patient, it can be snipped at the most dependent part with a pair of clean scissors. In any case, it should be covered with a piece of lint spread with boracic ointment. Healing usually takes place in about a week, and the dressing should be renewed twice in twenty-four hours.

Ointment. — Scott's dressing—an ointment containing camphor, olive oil, mercury, and yellow wax—is largely used as a counter-irritant in joint disease. It should be spread on lint, which is then cut into strips and wrapped round the inflamed joint. Lead strapping or plaster of Paris is frequently put over it, and is then left on for weeks, or even months. In some cases, however, it may cause an acute inflammation of the skin, and so must be used with caution.

Pressure.—This is used to diminish the amount of effusion into an inflamed limb or joint.

Methods.—Lead strapping cut into strips is applied round the limb, so that each strip overlaps about two-thirds of the strip below. It should be applied obliquely and from below upwards, and each strip should entirely surround the limb. It can be applied over cotton-wool or Scott's dressing, and must be evenly and smoothly put on. If put next the skin, the part should be first washed and shaved, and powdered with boracic powder, and the plaster can be made to stick by heating the reverse side on a hot-water tin, or moistening the plaster with turpentine. In removing it, carefully cut

down the centre and pull it off with a firm, quick movement. The skin can then be cleaned with turpentine, chloroform, or ether.

Other methods of applying pressure are by firm, even bandaging over cotton-wool, or by the use of elastic bandages, stockings, etc.

Massage, or Rubbing.—This (1) mechanically empties a congested part, causing a fresh flow of blood to it ; (2) causes a contraction of the muscular coats of the arteries by mechanical stimulation ; (3) empties the lymph spaces of the inflammatory exudation ; (4) helps to break down adhesions between contiguous surfaces. The principles and methods of performing massage will be found in Chapter XXI.

Constitutional Treatment.—As regards this in cases of chronic inflammation, there is little to be said, because the constitutional treatment depends essentially upon the disease which is the cause of the chronic inflammation. In most cases the patient ought to be supplied with suitable nourishing food, plenty of fresh air and exercise, as far as is consistent with the requisite rest of the part.

CHAPTER III

WOUNDS

Definition — Hæmatoma — Classification — Methods of healing — Treatment—Asepsis and antisepsis—Dressing of wounds—Diet.

Definition.—A wound is the solution of continuity of any of the tissues of the body in which the skin participates. If there be no solution in continuity of the skin, but the deep tissues are lacerated, there is a contusion, or bruise. If a contusion be associated with the extravasation of a large amount of blood, so that a definite swelling appears under the skin, the condition is spoken of as a hæmatoma or tumour of blood.

A hæmatoma is usually the result of some definite injury, but in some pathological states, such as scurvy, there may be no definite antecedent history, but the condition can usually be recognised by the staining of the skin by the effused blood.

Treatment of Hæmatoma.—Apply cold in the early stages to limit the amount of blood extravasated, later warmth to promote absorption.

Should suppuration occur, the surgeon will open it as if it were an abscess.

Wounds are divided into the following varieties :

1. **Incised Wounds.**—These are made with sharp cutting instruments. Bleeding is, as a rule, free; the lips of the wound gape, and there is no bruising of the edges. Healing takes place readily.

2. **Lacerated or Contused Wounds.**—These are made with blunt instruments. Bleeding is, as a rule, slight; the lips do not gape, and the edges are bruised. Healing may be protracted.

3. **Punctured Wounds or Stabs.**—These are made with pointed instruments, and are frequently dangerous from wounding important structures, such as the heart, although the external appearance may be slight. Foreign bodies, such as the point of a knife, are apt to be left in such wounds.

4. **Gunshot Wounds.**—These often contain bullets, the wadding of cartridges, or pieces of clothes, etc., carried in with the bullet.

5. **Poisoned Wounds.**—These include the bites of insects and snakes, but the most important are those that are poisoned with micro-organisms, such as those received in doing post-mortem examinations or septic dressings.

From a nurse's point of view a better classification is as follows:

1. **Aseptic Wounds.**—That is, such as are caused by the surgeon and remain aseptic, and which will heal readily.

2. **Wounds likely to become Septic.**—That is, wounds caused by any accident.

3. **Septic Wounds.**—That is, wounds in which suppuration has already occurred.

Methods of Healing of Wounds.—Wounds are said to heal in two ways—by first intention and by granulation. And under the second heading may be included healing under a scab, or with a blood-clot.

A wound heals by first intention when it remains perfectly aseptic, when the edges can be closely approximated, and the extravasation of blood is slight.

A tissue that is wounded first shows the signs of inflammation, being injured, but if no micro-organisms be present the effect of the injury soon passes off, and repair occurs.

In speaking of inflammation, it was seen that there was a multiplication of the connective-tissue cells of the part following the injury, and it is from these cells that repair occurs.

If an aseptic wound be looked at under the microscope two or three days after it was inflicted, the sides of the wound will be found to be stuck together by the inflammatory lymph, and the area of the wound itself surrounded by masses of small round cells, that are the result of the multiplication of the tissue cells. Lying among these cells will be seen many new capillary vessels which are formed from little buds which grow out from the capillaries already present. These little buds join together and spread amongst the cells, and stretch across the sides of the wound, so if the sides were forcibly separated bleeding would occur from the tearing of the vessels. This mass of new cells with new capillary bloodvessels is known as granulation tissue, and it contains more blood than the surrounding parts; the wound therefore looks redder than the normal tissue.

Soon between the new cells long fibres will appear, which are going to form new connective tissue. Gradu-

ally the fibres become more and more abundant, stretch across the sides of the wound, firmly uniting them together, so that it would be difficult to separate them. These fibres gradually contract, drawing the edges of the wound closer and closer together, and at the same time nipping and strangulating the new blood-vessels, which gradually disappear. The new tissue or scar thus becomes whiter than the surrounding tissue, because it contains less blood, and healing of the deeper tissue is now complete. Healing takes place in this way in all tissues except the skin and nerves. With these exceptions all true healing is by the formation of granulation tissue.

A wound becomes closed by the growth over it of the epithelium of the skin. Skin is composed of two distinct layers—the epithelium and the cutis vera, or true skin. The epithelium consists of several layers of cells, the most superficial of which have become horny, whilst from the cutis vera grow the hairs, the sweat glands, and the sebaceous glands. The cutis vera takes no part in the repair of a wound, but the epithelium grows in from the edges till it meets all over the wound. It will thus be seen that scars remain whiter than the normal skin, and have no hair, sweat or sebaceous glands, and so remain visible all through life. They also increase in size with the growth of the person.

Healing occurs by second intention, or by granulation, if the wound is not aseptic, if the edges cannot be brought together, or if they are separated by extravasated blood. In these wounds there is a large amount of granulation tissue formed in exactly the same way as in first-intention wounds, but the edges of the skin not being approximated, there is a constant discharge

taking place from the wound, until the epithelium has completely grown over it. This discharge, if the wound be aseptic, will be inflammatory lymph, but if micro-organisms are present it will be pus.

The granulations will eventually fill up the wound, and the epithelium of the skin will grow over it, and the granulation tissue will change into fibrous tissue, which will subsequently contract.

If the granulation tissue has been large in amount the contraction may be excessive, and deformity may occur, such as is seen in the wounds left after burns and scalds.

If the wound be large, and the separation of the edges great, the epithelium is unable to grow right across the granulations, and healing will not take place, especially if contraction be prevented by the wound being adherent to a bone. This is frequently seen in the chronic ulcer which occurs on the legs of women.

Healing under a scab is healing by granulation tissue. The scab consists of dried blood and inflammatory lymph, and is Nature's method of providing an aseptic dressing. The scab takes no part in repair.

So, too, in healing with blood-clot, the clot merely provides a material in which the cells and new blood-vessels grow. It takes no part in the process of repair, and is finally completely absorbed.

It will thus be seen that just as the changes that occur in inflammation are the same in all tissues of the body, healing takes place in the same way in all tissues, except in the skin and in nerve tissue.

If nerves are cut, and if the two ends are joined together, although the part which is more distant from the nerve centre always dies, yet new nerves are

formed, and in time new nerves will replace the old, and sensation and motion return to the part.

Treatment.—The modern treatment of wounds is carried out in two ways—aseptic treatment and antiseptic treatment.

The first method—aseptic—aims at the exclusion of all micro-organisms by absolute cleanliness—of the patient, surgeon, instruments, and all things and persons connected with the wound.

Sterilization is carried out by washing and by heat. No chemicals of any kind are used, as they cause irritation of the wound.

The second method—antiseptic—aims at the killing of all micro-organisms, and the prevention of their growth by the use of chemicals called antiseptics.

The first method is the ideal one, as there are no irritants of any kind used in the treatment, and the healing is left entirely to Nature; but in actual practice a judicious combination of the two is best. That is, all that is possible should be done by sterilizing—washing with soap and water, and heat—and the mild, non-irritating antiseptics should be used as an additional safeguard.

In considering the treatment of aseptic wounds, the case will be taken of an operation wound that heals by first intention.

Drainage.—Aseptic wounds are drained if the surgeon thinks there will be a large extravasation of blood, or if the tissues have been much damaged, and the resulting inflammation and pouring out of inflammatory lymph will be excessive. It is the absorption of this blood and lymph that causes aseptic traumatic fever. Drainage will allow the blood and lymph to

pass out of the wound into the dressing, so that the edges of the wound are not caused to gape by the amount of fluid present, and so healing is facilitated. Drainage is also used if the surgeon is not quite sure of the asepsis of the wound. If a drain is placed in an aseptic wound it should be removed on the second day, otherwise the wound should not be interfered with till it is time for the stitches to be removed.

The first dressing of a wound, whether to remove a tube or stitches, should be as carefully aseptic as an operation.

1. The hands should be washed as for an operation (see p. 11).

2. The following instruments should be sterilized: dissecting forceps, dressing forceps, probe, and scissors, and then placed in a bowl of weak carbolic (1 in 80).

3. A sterilized dressing and sterilized towels should be got ready.

4. The site of operation should be well exposed, and the bandage and outer layer of wool removed.

5. The hands should again be washed, and now nothing that is not sterilized should be touched until the bandage is on.

6. Arrange towels and remove all the dressing with dressing forceps.

7. Remove tube or stitches. If a tube, pull it slowly out, first cutting the holding stitch. Stitches should be gently pulled on one side till a part that has been buried in the skin is seen. This is cut through, and the stitch pulled out on the opposite side along the wound, so as not to cause the edges to gape.

8. Apply fresh dressing. The dressing must be absorbent, light, and aseptic, and the best is some form of gauze next the wound covered by cotton-wool.

9. Bandage evenly and smoothly, so as to exert a light, even pressure over the whole wound.

In aseptic wounds the first is usually the last dressing, unless drainage has been used. The wound has healed perfectly.

If drainage has to be continued, it is usually effected by means of gauze, and it is essential to differentiate between 'plugging' and draining a wound. A wound is plugged by the surgeon to stop hæmorrhage, and as much gauze as possible is pushed into the wound. A drain is to suck up the discharge from a wound, and should be a single strip of gauze passing right down to the bottom of the wound, with plenty of room for the discharge to come out.

If discharge continues to come along a channel from a wound, the condition is known as a sinus. Sinuses are caused by something in the bottom of a wound which prevents healing. This may be a foreign body, such as a stitch or ligature, or a piece of dead tissue, such as necrosed bone.

Wounds likely to become Septic.—These wounds are the ordinary wounds met with in civil life—*e.g.*, cuts from broken glass, cut throats, etc. The great danger is that they will become, or are from the first, infected with the various pus-forming organisms, so will not heal readily, and the patient be exposed to the dangers of cellulitis and septicæmia.

The aim of treatment in these cases is to render and then keep the wound aseptic, so that healing will follow as after an operation wound.

It must be remembered that the micro-organisms are almost universal, while the blood and tissues of the body are aseptic, and therefore the greatest care

must be taken in applying anything to the wound, as the best dressing is an aseptic blood-clot.

First Aid.—If hæmorrhage is severe, it must be arrested, but if the bleeding has stopped when the wound is first seen, it should be disturbed as little as possible. The application of linen rags, handkerchiefs, etc., is to be avoided, as they are almost sure to be septic; but a clean linen handkerchief fresh from the laundry is nearly aseptic, and may be used to cover the wound and to stop slight hæmorrhage.

It is important to avoid washing the wound in the first water that is at hand, or from any vessel that is near, as water is crowded with bacteria. Tap-water directly drawn from the tap, however, may be used to wash the wound if it be soiled with obvious dirt, as dirt frequently contains the tetanus bacillus (p. 63), and this must be got rid of at all costs.

Turpentine and methylated spirits are antiseptics that, as a rule, can be readily obtained, and may be used in the first aid to wounds, but the application of them is painful.

To sum up: Interfere with the wound as little as possible after bleeding is stopped. Remove obvious dirt with clean, boiled handkerchiefs. If necessary, on account of earth being in the wound, wash with fresh tap-water. Turpentine and methylated spirits are useful antiseptics.

Cover the wound with clean boiled linen, and leave it for the surgeon to deal with.

If every convenience is at hand, as in hospitals and dispensaries, the wound, after the hands have been sterilized, can be washed with one of the following solutions: Carbolic, 1 in 60; perchloride of mercury,

1 in 1,000; biniodide and water, 1 in 500; or lysol, 1 dram to 1 pint, and then covered with an antiseptic compress soaked in the same antiseptic. But compresses of carbolic should not be used for the fingers and toes, otherwise gangrene may result. The compress should be secured with a bandage.

Treatment.—If the wound be a severe one, the surgeon will administer an anæsthetic, then thoroughly scrub the surrounding skin with soap and water to remove all dirt. The wound will then be thoroughly cleaned with antiseptics, tendons sutured, vessels tied, and the wound closed with sutures. As these wounds have had irritating antiseptics applied, and have probably been infected before treatment is commenced, the surgeon will most likely drain the wound for twenty-four or forty-eight hours. An aseptic dressing is applied, and, if necessary, a splint. The after-treatment of such a wound is the same as that of an operation wound.

Septic Wounds.—In dealing with septic wounds, the case will be taken of an operation wound that has been infected at the time of the operation with pus forming micro-organisms, and which, instead of healing by first intention, suppurates.

After the infliction of all wounds, it has been shown that there is a slight rise of temperature, which usually falls to the normal again in twenty-four hours—the aseptic traumatic fever.

If, however, the wound is going to suppurate, the fall does not take place, but the temperature continues to rise, often reaching 103° or 104° F. on the third day. At the same time the wound becomes painful, and the surrounding tissues swollen. The patient's face will

be flushed, and he will complain of headache. The tongue is furred, the appetite lost, and the bowels confined. The patient is said to be suffering from general malaise. In some severe cases the patient may be delirious, and the pulse and respiration rate is increased. The patient is now suffering from septic traumatic fever caused by the absorption of toxins, or poisons produced by the micro-organisms growing in the wound. If a patient presents these symptoms, the wound should be looked at, and it will be seen that there is no attempt at repair ; the edges of the wound and the surrounding tissues are swollen with fluid (œdematous), the skin round is red and hot, and the patient will complain if the wound is touched.

If the edges of the wound are separated by means of a probe or by loosening a stitch, pus will ooze out, or a dark, blood-stained fluid will escape.

Treatment.—Although the wound is already septic, it is important that the same precautions should be taken as in an aseptic wound, because infection is not due to one variety of micro-organisms, but to many. A wound infected with one form may subsequently become infected with another, and the condition be much aggravated. Asepsis should therefore be thoroughly carried out. The first consideration is to evacuate the pus ; this is usually done by removing a sufficient number of stitches, and putting in either a drainage-tube or a gauze drain. Directly the pus is given free vent the toxins are no longer absorbed, the temperature will fall, and the general condition of the patient improve. After this is done, the general treatment of inflammation should be carried out, especially the application of heat by means

of fomentations, which should be made with some antiseptic, so as to help in the destruction of the micro-organisms.

If the inflammation is severe and the poisoning of the patient profound, injections of serum will often be ordered, especially the antistreptococcic serum, as the streptococcus is the most frequent cause of acute suppuration in operation cases.

The method of giving these and the precautions to be used are given on p. 56.

The diet of the patient should be light and nutritious, the bowels kept well open, and, if the general condition is poor, stimulants—especially port wine—should be given.

Antiseptics.—The use of antiseptics is not without danger, as they are drugs which are poisonous to man, as well as destroyers of bacterial life. The quantity that can be used with safety varies considerably in different people, and there is no means of ascertaining beforehand the effect of any of them on an individual patient. Iodoform, for example, in the smallest amount will produce an extensive eczema in some people, whilst others can absorb large quantities of the drug without harm resulting.

The nurse must be aware of the early symptoms of poisoning by the most largely used antiseptics, so that she can report to the surgeon, and so that precautions may be at once taken to counteract their effects.

Mercury, either as the perchloride or biniodide, can cause symptoms of poisoning by being absorbed from dressings or from lotion used to wash out wounds or cavities. From dressings it is most likely to cause

symptoms if the perchloride gauze used is applied moist, and quite a small amount may cause severe symptoms. Thus, a case of amputation of the breast died from mercurial poisoning, although the antiseptic was only used in the dressing, which consisted of pads containing 1 per cent. solution of the perchloride.

The local symptoms consist of an eczema with persistent itching and burning of the skin, and may occur with symptoms of general poisoning.

The general symptoms are a feeling of dizziness, restlessness, general malaise, and vomiting ; the mouth is sore, the gums inflamed, and there is a copious secretion of saliva. Later there may be severe diarrhœa, which is often blood-stained. The urine contains albumin, and the mercury may be detected in it.

Treatment.—Preventive. When perchloride gauze is used as a dressing, it should be applied dry, and if the lotion is used for syringing out a cavity, all excess must be carefully wiped away and the wound left quite dry.

If poisoning occurs, the use of the mercury must be immediately stopped ; the rest of the treatment is symptomatic—*i.e.*, the treatment of the symptoms as they arise.

Carbolic Acid.—The symptoms of carbolic acid poisoning are headache, dizziness, nausea, and vomiting. The urine changes from its natural colour to olive-green or black, and is an important symptom in making the diagnosis ; but the intensity of the poisoning bears no constant relationship to the intensity of the discoloration of the urine. With very dark urine the patient may be very well.

In some cases the urine contains albumin or even blood, and at the time when the carbolic spray was used this was a symptom sometimes seen in the operator.

Treatment.—The use of the drug should be stopped immediately, and the symptoms treated as they arise. Sodium sulphate may be given to hasten the excretion of the carbolic by the kidneys.

If the poisoning is produced by swallowing carbolic acid, the stomach should be immediately washed out, as carbolic is not one of the corrosive acids.

Iodoform.—This is used in dressings as iodoform gauze or iodoform powder, and is also injected as iodoform emulsion. It must be used with care, particularly if the patient is aged or anæmic, or is a child, or has a diseased heart or kidneys, as many fatal cases of iodoform poisoning are on record.

The milder cases of poisoning are characterized by a rapid, irregular pulse, want of appetite, nausea and vomiting, headache, general malaise, and a depressed state of mind.

Locally there may be an intense eczema, with great itching and burning. In more severe forms the symptoms may take one of two types :

1. The pulse is rapid and small, there is sleeplessness, delirium, hallucinations, and refusal to take food. Recovery usually takes place if the use of the drug is stopped.

2. After a brief period of excitement there follows a general paralysis of the central nervous system, loss of consciousness, coma, and incontinence of urine and fæces. These cases usually prove fatal.

Treatment.—After the immediate removal of the iodoform dressing the treatment of iodoform poisoning is purely symptomatic, and in the severe cases no treatment is of any avail. The symptoms may continue long after the use of the drug is stopped, and one case is on record of death occurring twenty-nine days after the onset of the symptoms, although the use of the iodoform was stopped at once.

CHAPTER IV

ACTION OF MICRO-ORGANISMS AND SPECIFIC INFECTIOUS FEVERS

Definition—Toxins—Local infectious fevers—General infectious fevers—Theories of action of leucocytes of blood serum—Antitoxins: their preparation—Erysipelas—Cellulitis—Rigors—Convulsions—Septico-pyæmia—Tetanus—Hydrophobia—Tuberculosis—Syphilis.

Two varieties of fever, caused directly by wounds, have already been considered:

1. Aseptic traumatic fever, due to the absorption of some of the constituents of inflammatory lymph and blood serum (probably fibrin ferment).

2. Septic traumatic fever, due to the contamination of wounds by micro-organisms.

There is a third variety, also due to micro-organisms—the specific infectious fevers.

They are called specific because each is caused by a special or specific micro-organism which is peculiar to that disease, always accompanies it, and causes no other disease, and which can be found and identified by the bacteriologist. They are called infectious because the patient has been infected with the micro-organism, and is capable of infecting other people. Many, or most, of these diseases belong to the province of medicine, such as diphtheria, small-pox, typhoid fever, etc., but others are so intimately connected with

wounds that they belong to the province of surgery, and their treatment forms a large branch of surgical work. The most important are erysipelas, cellulitis, septico-pyæmia, anthrax, glanders, tetanus, hydrophobia, and tubercle.

A specific infectious fever has a train of clinical symptoms by which we recognise it, and it is necessary to understand how these symptoms are produced.

There is a wound which may be severe—*e.g.*, a compound fracture—or very slight, such as a prick from a pin, and this is infected with the special micro-organism. As a consequence there follow the local symptoms of inflammation—redness, swelling, heat, and pain—which are severe in some diseases, such as erysipelas, slight in others, such as tetanus.

The micro-organism grows and multiplies in the wound, and produces by its growth certain poisons, or, as they are usually called, toxins. The toxins are the products of the growth of the micro-organisms, in the same way that carbonic acid gas and urea are the products of growth of the higher animals; and just as carbonic acid gas and urea are poisons to other individuals as well as to the person who produces them, so toxins are poisonous to the individual in whom the micro-organisms are living, and they are also poisonous to themselves, and growth of the micro-organisms will cease if the products of their activity are not removed. In the body they are absorbed into the circulation and carried away, so the micro-organism continues to flourish, whilst the individual is being quickly or slowly poisoned, according to the number of organisms present. In the same way, too, that ventilation is necessary to remove the carbonic acid gas formed by

animals, so drainage of a wound is necessary to remove the toxins formed by micro-organisms.

It is the absorption of these toxins into the blood which causes the *general* or *constitutional* symptoms of the patient, and as each micro-organism has its own peculiar toxins the symptoms will vary in each disease.

There are thus two sets of symptoms to be considered —the local, which are inflammatory, and the general, which are symptomatic. As the poisons are in the blood, and the blood goes to every organ in the body, all the organs suffer, though some more than others, and the patient therefore suffers from general specific symptoms as well as the special symptoms of the disease. These are loss of appetite, nausea, headache, constipation, fever, furred tongue, etc. All these symptoms are spoken of in the term general malaise.

To sum up, the micro-organism growing locally in a wound causes local inflammation, and by the absorption of its toxins causes symptoms by which we recognise the disease, and which may cause the death of the patient.

These diseases are known as the local infectious fevers —*e.g.*, tetanus.

There is, however, another class of case in which the general symptoms depend upon the invasion of the blood-stream by the micro-organisms themselves, as well as by their toxins. These are the general infectious fevers — *e.g.*, septico-pyæmia — the organism being general through the blood-stream, and they are more dangerous as a rule than the local infectious fevers; for while the organisms remain local they can be dealt with by drainage, antiseptics, or in some cases by amputation, but, when they have once invaded the blood-stream, it is impossible to remove or kill them without at the

same time killing the patient, and treatment consists of counteracting the action of their toxins.

To understand the treatment of these cases it is necessary to know the way in which Nature cures these diseases, and there are two theories which must be considered.

The first, which we owe to Metschnikoff, gives the power of destroying the micro-organisms to the *leucocytes* or white cells of the blood. Briefly, this theory is as follows :

The micro-organisms, having settled in the tissues, growing there, and producing their toxins, cause the phenomena of inflammation, and the white cells leave the bloodvessels and surround the invaders. A battle ensues between the leucocytes and the bacteria, the leucocytes trying to engulf and then digest the micro-organisms, the organisms killing the leucocytes by the production of toxins. Should the white cells triumph, the bacteria are eaten and destroyed, no more toxins are produced, and the patient is well again, except for the effects of the general poisoning that has been going on during the battle. But if the bacteria win, the leucocytes are killed, and now become the cells of pus, whilst the bacteria rapidly multiply, the amount of toxin increases, and the patient succumbs to general poisoning. This theory of 'the battle of the leucocytes' has given way in recent years to the theory of antitoxins, which we owe to Buchner.

According to this theory, the presence of the toxins in the blood stimulates all the cells of the organs of the body to produce antidotes for the poisons, so as to chemically counteract them, just as in poisoning by drugs antidotes are given to neutralize the effects of the drug. These antidotes produced by the tissues

are called antitoxins, and just as each organism has its own toxins, so each toxin has its own antitoxin, and the antitoxin produced will therefore vary with the micro-organism causing the disease. And in treatment by antitoxin it is necessary to know the special organism causing the disease, so that the special antitoxin may be used.

The best-known antitoxins are the antidiphtheritic toxin and the antistreptococcic toxin, but many more are being discovered.

After the antitoxin has counteracted the toxins, they kill or weaken the micro-organisms, which thus become inert, and the leucocytes are then able to digest them and remove them from the body.

To illustrate the method of production of an antitoxin for medicinal use, the antidiphtheritic serum may be taken.

A horse free from all disease is selected, and a quantity of the toxins of the diphtheria bacillus is injected into it, the dose not being sufficient to kill the animal. The tissues of the horse then produce antitoxin, which circulates in the blood. As soon as the animal recovers, another and larger dose is injected, and again antitoxins are produced. This is continued till the horse is able to stand what would have originally been a fatal dose, the serum of the blood having become saturated with antitoxins.

The animal is now bled, the blood caught in a vessel, the clot consisting of the red and white cells removed, so that only the serum is left containing the antitoxin.

This serum, which is obtained under antiseptic precautions, and is sterile, is now injected into a patient suffering from diphtheria, and the antitoxin of the horse neutralizes the toxins which the diphtheria

bacilli are producing in the patient's body, and so helps the cure.

From the above it will be seen that there are four ways in which Nature can be assisted in the cure of the specific infectious diseases :

1. Removal of the micro-organisms and their toxins by drainage or amputation.

2. Killing the micro-organisms with antiseptics.

3. Improving the general condition of the patient, so that he can produce an abundance of antitoxins, and giving him stimulants to tide him over the stage of acute poisoning.

4. Giving him the antitoxin of the particular disease from which he is suffering.

Method of Injecting Antitoxins. — It is essential that doses of antitoxins should be injected with full antiseptic precautions, otherwise a patient may be infected with a second disease in addition to that from which he is already suffering. The following rules should be carefully observed :

1. Inject into a part where the skin is loose—*e.g.*, groin.

2. Prepare patient's skin as for operation (see p. 127).

3. Cleanse the hands as for operation (see p. 11).

4. The syringe must be sterilized by boiling, and if the injection is not used directly out of the bottle it must be poured into a sterilized dish.

5. The injection should be given slowly, and the *exact* dose ordered should be given.

6. Cover the puncture with collodion, so that none runs out again.

A different part of the body should be used for each injection, and if much inflammation results, the part should be covered with evaporating lead lotion.

The Specific Infectious Fevers.

Erysipelas and Cellulitis.—Erysipelas is a spreading inflammation of the skin due to a micro-organism—the *Streptococcus pyogenes*; whilst cellulitis is a similar inflammation affecting the subcutaneous and intermuscular tissue, and is due to the same organism.

The patient has a small wound or scratch by which the micro-organism gains entrance. Its increase and growth cause the local inflammatory signs, whilst the absorption of its *toxins* causes the general or constitutional symptoms.

The incubation period—that is, the time between inoculation and the appearance of the symptoms—is short—about twenty-four hours—and the constitutional symptoms usually start with a rigor and vomiting. The temperature rises to 103° or 104° F., the pulse is rapid, the tongue furred, and there is loss of appetite and constipation. At the same time the local signs appear. The wound looks inflamed, healing ceases, and round it appears a bright red, rosy rash, which has a sharply-defined edge, and is covered with small blebs. There is much swelling of the parts where the subcutaneous tissue is loose, as in the eyelids, and the patient complains of a burning pain in the part.

The rash gradually spreads at the edges, whilst disappearing in the centre, and it may involve the whole body, the temperature remaining high; but in a favourable case after four or five days the rash fades and the temperature falls.

The fall of temperature in a typical case is by crisis—*i.e.*, an abrupt fall to normal—the rash fades from the skin, the œdema disappears, and recovery is com-

plete. Desquamation or peeling usually follows, and if the scalp is involved the hair is lost. In old people or others debilitated from any cause the patient may pass into a state of muttering delirium with weak pulse —*i.e.*, the typhoid state—and death may end the disease.

Erysipelas may occur after operation, and if so the case must be at once isolated from all other surgical cases, and the nurse must on no account attend other surgical or gynæcological patients.

In hospitals a special ward is set apart for the treatment of erysipelas and cellulitis, and the nurses in these wards should not attend other surgical parts of the hospital. It is also important for the nurse to make sure that she has no wounds or scratches on her hands, arms, or face, otherwise she may herself contract the disease and run a risk of losing her life.

The first point in the nursing of these cases is the treatment of the rigor.

A rigor is due to the absorption of a dose of bacterial poison, and occurs in many diseases, but in surgical cases is especially associated with the pus-forming (pyogenic) organisms.

The symptoms are divided into four stages:

1. **Cold Stage.**—The patient complains of feeling cold, shivers, the face is pinched and blue, and the skin feels cold. If, however, the temperature is taken (especially if taken in the rectum) it is found to be steadily rising to 103° or 105° F.

2. **Warm Stage.**—The patient gradually feels hotter and hotter, the face becomes flushed, the pulse is rapid and full, and there is usually intense headache. The temperature, at first stationary, commences to fall.

3. **Sweating.**—The patient now sweats profusely, and the temperature falls to normal or below.

4. **Collapse.**—The pulse is rapid and weak, and the temperature subnormal.

The rigor lasts for variable periods of time, about half an hour being the average, and it may be repeated at intervals during the illness. In the first stage the patient feels cold with a rising temperature, because the bloodvessels of the skin are contracted; and warm in the second stage with a falling temperature, because the superficial bloodvessels are dilated.

Treatment.—In the cold stage, warmth. The patient should be wrapped in a hot blanket, and plenty of blankets put on the bed, in which are placed hot-water bottles. Hot milk is given, or, if ordered, hot brandy and water.

In the second stage of *warmth* it is important to see that the patient does not throw off the blankets too readily, and run the risk of a serious chill. They should be removed one by one, and the hot bottles taken away. Antipyrin is useful for the headache, but should not be given without the doctor's orders. Warm sponging, if the room is warm, is useful.

In the stage of *sweating* the patient will appreciate warm sponging to remove the perspiration, and then careful drying with light friction.

In the stage of *collapse* stimulants are necessary, but they should only be given by the nurse if they are urgently needed, and it is impossible to send for the surgeon in charge.

In conditions in which rigors occur in adults convulsions are common in children.

Convulsions.—Causes.—1. Gastro-intestinal disturbances, indigestion.

2. Cutting teeth, phimosis, ear trouble.

3. Rickets.

4. Onset of the infectious fevers.

5. Forerunner of serious nervous diseases, such as hemiplegia or infantile paralysis.

Symptoms.—A convulsion starts with a period of restlessness, during which the face twitches and the child grinds its teeth.

The spasms, as a rule, start in the hands, and affect gradually the whole body. The eyes are fixed and staring, or roll about. Spasms of the respiratory muscles occur causing congestion of the face, which is contorted. The head is usually retracted. After the convulsion the child, as a rule, sleeps, or it may pass into further convulsions in which it may die. Death during a fit is rare, but does occur.

Treatment.—The child should be placed in a hot bath (95° or 96° F.), and well sponged, adding a little more hot water from time to time. A very hot bath is contraindicated, especially if the trouble be due to indigestion or an overloaded stomach.

The bath should never be given for longer than fifteen minutes—four or five is often all that is necessary. The child should then be dried with a warm towel, and wrapped in a blanket and put to bed. If older than an infant, care should be taken that the tongue is not bitten, by putting a piece of cork or an indiarubber ring between the teeth.

If ordered, syrup of chloral should be given, either by means of the nasal tube or by the rectum.

Besides the treatment of rigors or convulsions in a

case of erysipelas, the nurse should pay particular attention to the pulse and respiration. In cases occurring in old people, as has been mentioned, the patient may pass into the typhoid state, the pulse will get quicker and quicker, and the respiration shallow. These cases need constant attention, the patient tending to sink down in the bed and to develop bed-sores. Œdema of the lungs will occur if the patient is kept in the dorsal position, and it is therefore important to prop them alternately on the right and left side with pillows.

These cases are examples of what is known as asthenic (without strength) fever, while the cases occurring in robust young adults with high fever and delirium are called cases of sthenic fever.

The rules for isolation and disinfection of the patients and nurses are the same as those for diphtheria (see p. 166).

Cellulitis is an acute infective spreading inflammation of the cellular tissue, due to the *Streptococcus pyogenes*, and has the same general or constitutional symptoms as erysipelas, being due to the same organism. It attacks operation-wounds where the precautions against sepsis have failed, but is more common in accidental wounds, such as compound fractures. As before stated, the symptoms are similar to those of erysipelas, and may be either of the sthenic or asthenic type.

The wound is tender and acutely inflamed, all healing ceases, and the surrounding parts are red in colour, brawny to the touch, and œdematous. If the inflammation be very acute, the tissues may become gangrenous (the 'mortification' of the laity). If within

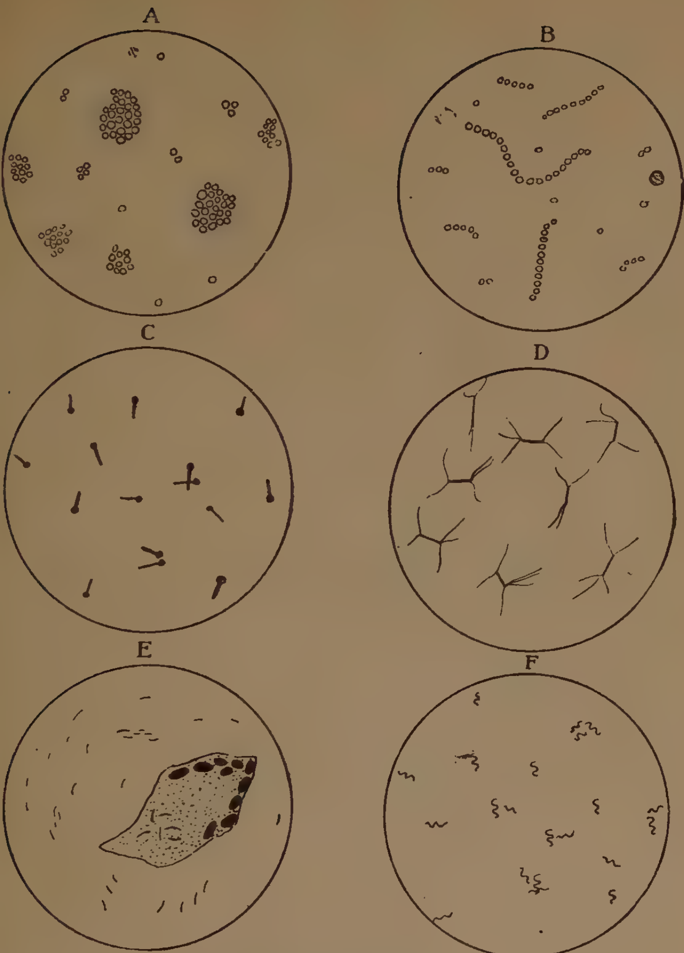
forty-eight hours of an operation the temperature rises, the patient has a rigor, and complains of pain in the wound, this complication has probably occurred, and the surgeon should be warned.

The treatment will probably consist of removal of the stitches, draining the wound, and the application of fomentations. Later free incision into the part, or if a limb amputation may be necessary.

The same precautions against infection are necessary in nursing these patients as in cases of erysipelas, and they must be watched for the same complications. Bed-sores readily form, owing to the septic condition of the patient, and hypostatic pneumonia is always to be feared.

Septicæmia and Pyæmia (Septico-pyæmia).—In the two preceding diseases due to the pyogenic (pus-forming) micro-organisms the bacteria have remained local, and not infected the blood-stream. All the general symptoms are due to the absorption of toxins, and directly the micro-organisms are killed the manufacture ceases and the patient recovers.

In some cases the micro-organisms actually enter the circulation, and are carried round by the blood-stream, multiply in it, and infect all parts of the body. This condition of invasion of the blood is known as septicæmia, and if the micro-organisms are arrested at any part of the circulation they multiply there and cause an abscess to form, so that the patient may have abscesses occurring in any or every part of the body. When these secondary abscesses occur the condition is spoken of as pyæmia, but as all cases of pyæmia must be cases of septicæmia too, and a case of septicæmia may at any time get a secondary abscess formed,



Micro-organisms.

A. *Staphylococcus pyogenes* (in groups).
B. *Streptococcus pyogenes* (in chains).
C. *B. tetanus* with spores.
D. *B. tetanus* with flagella.
E. *B. tuberculosis* (some seen in a cell).
F. Spirilla of relapsing fever.

To face page 62

the two diseases may be classed as one—septico-pyæmia.

Septico-pyæmia may be a complication of any wound, however trivial, or however large, but is particularly liable to attack people who are broken down in health.

Fortunately—for it is a very fatal disease—it is getting rarer, owing to the use of antiseptics, and the aseptic treatment of wounds; but cases are still common, and it usually complicates accidental wounds. It still occasionally follows operation-wounds, and this is due to the want of surgical cleanliness, and is a reproach to all concerned in the operation.

The symptoms aro of course similar to those of cellulitis and erysipelas, but more severe. The patient rapidly passes into a state of extreme prostration. The pulse is quick and feeble, respiration rapid and shallow. The patient has a peculiar sallow, earthy look, and ofter suffers from a profuse, evil-smelling diarrhœa. There is nothing fresh to be added in the nursing of these cases to that already given for cellulitis, but the danger in infection is increased, and the nurse should always see that she has plenty of fresh air and good food whilst looking after a case of septico-pyæmia.

Tetanus, or **Lockjaw,** is an acute infective disease due to the tetanus bacillus, and not, as was formerly thought, due to the cutting of nerves. The bacillus, which can be easily grown, lives in garden earth; and wounds into which dirt has been ground must be most carefully cleaned in view of this very fatal disease.

The incubation period varies from a few hours to weeks, and the sooner after the accident the symptoms

appear the more fatal the disease is. It can be taken as a working rule that if the spasms of the muscles start within four days of infection the termination is invariably fatal.

The disease first shows itself in spasms of the muscles of the jaws and neck, and with inability to open the mouth (lockjaw), and the spasms then spread to the rest of the muscles of the body till all are involved. At the same time the patient suffers from general symptoms, such as rise of temperature and constipation. It is important to recognise the difference between the spasms of tetanus and those of strychnine poisoning. In strychnine poisoning the spasms last for a short time, and then pass off completely till some stimulus starts them again, in the interval the patient's muscles being completely relaxed ; whilst in tetanus, although spasms are started by stimuli, such as a touch or a noise or a bright light, yet the muscles never completely relax till the patient is either dead or has recovered. Strychnine affects the muscles of the hands and feet first, and not the jaw muscles.

Patients with tetanus die from exhaustion, heart failure, or asphyxia due to spasms of the respiratory muscles.

In the nursing of these cases it is important to see that the patient is kept as quiet as possible ; the room should be darkened, no visitors allowed, all noises—such as shutting doors, opening windows, etc.—must be avoided. The nurse should put coals on the fire with her hands, and should be particularly careful to move about quietly, and to avoid touching the bed or the patient more than is absolutely necessary.

Feeding is often difficult, owing to the spasm of the muscles of the mouth and larynx, and it may be neces-

sary to feed with the nasal tube, or to give food while the patient is anæsthetized.

The medical treatment will consist of the giving of antitoxin, either into the subcutaneous tissue or injecting it straight into the spinal cord, and keeping the patient under the influence of sedatives, such as morphia, chloral, or chloroform. Surgically the wound will be excised or the part may be amputated.

Tetanus is occasionally seen in the new- born (trismus neonatorum), owing to the infection of the umbilical cord with dirty dressing at the time of birth. The spasms usually start about the ninth day, and the disease is popularly known as 'nine-day fits.' It is commonly fatal.

Hydrophobia is a specific infectious disease most probably due to a micro-organism, but this has never been proved. It is called rabies in dogs, wolves, cats, and other animals, and is transmitted to man by bites of animals suffering from the disease. The most dangerous bites are those on the hands and face, and on the bare legs of children, as the poison is contained in the animal's saliva, and if the bite takes place through the clothes the teeth are wiped clean.

The incubation period is curiously long—two weeks to two years—and in this stage there are no symptoms, the wound healing perfectly. On the onset of the disease the patient suffers from melancholia, and then follow difficulty in swallowing and breathing, due to spasm of the muscles of the larynx and pharynx. The difficulty of swallowing increases, making it impossible for the patient to get rid of his saliva, which runs out of his mouth—the so-called 'foaming at the mouth.' The thought of drinking increases the spasm, which is

exceedingly painful, and so the patient shuns the sight of water (hydrophobia meaning water madness), but the mind usually remains clear to the end, although hallucinations may occur ; paralysis gradually comes on and death follows, for the disease is always fatal, no authentic case of recovery being on record.

The preventive treatment is excision of the wound, or cauterizing it with nitric acid, nitrate of silver, caustic potash, pure carbolic acid, or actually burning it with a red-hot iron. As it is necessary for this to be done within half an hour of the bite, a nurse is fully justified in doing it herself in the case of a bite from a mad dog, if it is impossible to get a medical man in that time. Sucking of the wound is useful, and quite safe if there be no cracks on the lips.

Besides this, there is Pasteur's treatment by the injection of small doses of toxin got from the spinal cord of rabbits inoculated with the virus.

This is successful in preventing the disease, though it never cures it.

Tuberculosis.—This is a specific infectious disease due to the tubercle bacillus, which may cause an inflammation limited to one organ (local tuberculosis), or may be generally diffused through the whole body (general tuberculosis). The presence of the tubercle bacillus in any part causes essentially a chronic inflammation of that part, often ending in a slow form of suppuration called caseation, whilst the absorption of its toxins causes a general malaise of the patient, showing itself in loss of strength, night-sweats, want of appetite and animal spirits, and nocturnal rise of temperature. The local changes caused by the tubercle bacillus are called by various names in various parts of

the body: thus in the lungs it is spoken of as phthisis or consumption, in the bones as caries, in the skin as lupus, but in all cases the lesion is the same—inflammation usually chronic, but occasionally acute or subacute.

The bacillus gains admission into man:

1. By the digestive tract, as in milk taken from cows with tuberculous udders.

2. By the respiratory tract, as by the inhalation of the dust of dried phthisical sputa.

3. By direct inoculation through the skin by the infection of wounds.

The bacillus is carried by the blood-stream about the body till it settles in some place, usually where slight injury has occurred, and there grows and produces its characteristic lesion. Two things are therefore necessary to set in action a tuberculous process—the *seed* and a *suitable soil.* The seed, the tubercle bacillus, is very liberally distributed among the haunts of men, and tuberculosis would be more common than it is if the suitable soil were not of much greater importance than the seed. Tuberculous diseases may be acquired, but probably cannot be inherited. That is to say, the parent cannot hand down to its offspring the tubercle bacillus, but, unfortunately, the parent can transmit a body whose tissues form a suitable soil for the development of the bacillus, should that organism reach it in sufficient strength.

A predisposition, not a disease, is inherited. Inheritance of the predisposition is not, however, necessary for the development of the disease, but the suitable soil may be acquired by living under bad hygienic surroundings with insufficient air, insufficient sunlight, insufficient exercise, and insufficient food, especially if this condition occur during the period of growth.

It will then be seen that any individual may suffer from tuberculosis, and that there is no physiognomy that is diagnostic of the disease. Still, two types of individuals are commonly met with amongst the sufferers from this complaint, and they have been named the sanguine and the phlegmatic type.

The sanguine type have fine, regular features, delicate hands, clear white skins in which the veins show clearly. Their eyes are bright, and the lids have long lashes. The hair is long, fine, and silky, and grows down to meet the eyebrows as a fine down. Intellectually, they are sprightly and emotional.

The phlegmatic type are short and bulky, with large hands and feet. The features are coarse and irregular, the skin thick and harsh, and the muscular outline of the body concealed by the subcutaneous tissue ; there is little muscular power, and they are apathetic and without vivacity. It is this type that is common in the slums of large cities.

The lesions due to tubercle are usually of a very chronic and indolent character. They are set up by very slight causes, and they have a marked tendency to suppuration and progressive destruction of the tissues, though firm healing by fibrous tissue may occur.

Usually the lesions are very intractable to treatment, and at any time the patient may develop a general dissemination of the tubercle through the body, and death will then occur.

If suppuration occur due to the tubercle bacillus, the collection of pus is known as a 'cold' abscess, as the signs of inflammation are not well marked, and the toxins absorbed do not cause marked constitutional symptoms. These cold abscesses may contain over

Phlegmatic and Sanguine Types of Tuberculosis.

½ pint of pus without the patient suffering much pain or showing marked signs of general poisoning.

This pus is infectious, but not readily so.

An infection of a cold abscess with staphylococcus or streptococcus may occur, and then the signs of inflammation will become marked and the spread of the abscess will be rapid.

Treatment.—The treatment of tuberculosis should be both constitutional and local.

Constitutional treatment consists in placing the patient under the most perfect hygienic conditions, especially as regards fresh air and sunlight, both of which he should have in abundance. The diet should be nourishing, with plenty of milk, cream, and fat, and this last can be given in the form of cod-liver oil.

Local treatment is like that of chronic inflammation due to other causes (see p. 33), but, above all, long periods of absolute rest are essential. For example, in tuberculosis of the spine (caries of the spine, or Pott's disease) the patient, if a child, must be kept in a recumbent position for two years, and after that movement of the spine limited by the wearing of a spinal jacket.

If, in spite of rest, the process does not stop, and the part affected is accessible to surgical interference, the tubercular inflammatory tissue may be cut away, as in excision of joints, or scraping with a sharp spoon will remove the diseased tissue.

Cold abscesses are treated like other abscesses, by incision and evacuation of the pus.

Syphilis is a specific infectious disease the cause of which is unknown. Most probably it is due to a

micro-organism, but up to the present no one has succeeded in proving this to be so, and the cause, whatever it may be, is usually spoken of as the virus of syphilis. To contract the disease, direct contact with the secretion from the wound of a patient suffering from the infection must occur, and the contact may occur from touching the patient himself or any article he has used on which the secretion has remained.

The disease is divided into three stages—the primary wound or chancre, the secondary stage, and the tertiary or gummatous stage. The primary chancre can occur on any part of the body, provided a wound exists through which the patient is inoculated, and the incubation period is about three to five weeks. The discharge from the chancre is highly infectious, but the patient does not exhibit any constitutional symptoms.

About twelve weeks after infection the secondary stage starts, and lasts for about two years. This is the period of infection of the whole body, and all lesions occurring on the body during this stage are infectious.

The chief symptoms the patient exhibits are general malaise, various rashes on the body, ulceration of the mouth, pharynx, and tonsils, loss of hair, enlargement of lymphatic glands, and the presence of soft, wart-like lesions in the groins, axillæ, and folds of the buttocks. These warts are known as condylomata, and the secretion from them is highly infectious.

In nursing a patient who is suffering from primary or secondary syphilis (and these cases may require operation) the utmost care to prevent personal infection must be taken.

Everything that comes in contact with the patient

must be marked and used for that patient alone. This includes all domestic articles—cups, glasses, shaving materials, towels, sponges, soap, etc.; all surgical instruments and apparatus, and all utensils used in nursing. All dressings should be at once burnt; instruments after use should be sterilized by boiling; and all clothing must be carefully disinfected before being sent to the laundry. Linen shirts, sheets, etc., should be soaked for twenty-four hours in 1 in 20 carbolic lotion or 1 in 1,000 perchloride of mercury. Woollen materials—blankets, etc.—should be fumigated.

Immediately after touching the patient for any purpose whatever the hands must be washed well with soap and water, and then rinsed in 1 in 1,000 perchloride of mercury solution. It is well to keep a bowl of this antiseptic near the bed, but merely dipping the hands in this is not sufficient; good scrubbing with soap and water is essential, otherwise the nurse may contract a loathsome disease—the consequences of which will poison the rest of her life, even if it does not directly cause her death.

It must not be forgotten either that the nurse may convey this disease to another patient, and, by a carelessness which is criminal, help to spread a disease which is one of the curses of modern life.

In dressing these cases, the fingers should not be used to remove a dressing, and all direct contact with the patient should be avoided. This infectious stage lasts about two years, and is followed by the tertiary stage, from which a patient is never safe.

As long as twenty or thirty years after the secondary stage, and the patient apparently being healthy in the interval, the typical lesions of tertiary syphilis may

appear, and may directly or indirectly cause the death of the patient.

The lesions of tertiary syphilis are essentially those of chronic inflammation, and the central nervous system is perhaps particularly prone to be attacked, causing such diseases as general paralysis of the insane and locomotor ataxy.

No organ or part, however, is safe—the liver, the kidneys, the joints, the eye, the ear, all in their turn showing the symptoms of chronic inflammation ; and thus amongst the symptoms of the disease we have ascites, albuminuria, lameness, blindness, and deafness. The chronic inflammatory tissue may undergo a curious change allied to suppuration, called gummatous degeneration ; a swelling resembling a cold abscess appears, comes to the surface of the body and bursts, forming a foul ulcer which may continue to spread. These gummatous ulcers may occur anywhere and cause great destruction ; for example, a gumma on the head may cause necrosis of the skull-bone, perforation, and cerebral abscess, and in healing by fibrous tissue may cause stricture of the various organs of the body, such as the larynx or rectum.

The discharge from these ulcers in the tertiary stage is only slightly, if at all, infectious, and the very stringent precautions necessary to the primary and secondary stages are perhaps not necessary ; but great care should of course be taken, both on account of the syphilis and of the septic organisms that are always found with these ulcers.

Congenital Syphilis.—Unfortunately, the person who contracts syphilis is not the only sufferer, but the disease can be directly transmitted to the off-

spring, and that, too, when the patient has apparently recovered, and is quite free from any trace of the disease.

The inheritance can take place from the mother or from the father, and the disease runs the same course as the acquired, except that the primary lesion is omitted.

The child may be born with syphilitic lesions on it, but more commonly is quite healthy at birth.

About the age of one month, in spite of the utmost care, the child begins to waste, and takes on the appearance of old age. Rashes appear on the buttock, sores on the mouth, condylomata may be present, and the child suffers from 'snuffles' (*i.e.*, a chronic discharge from the nose). This corresponds to the secondary stage of the acquired form, and all the lesions are highly infectious, so that the nurse may contract the disease from such a child; and the same precautions must be taken in the nursing of these cases as given before. Curiously, although the mother may have showed no signs of the disease, she cannot contract the infection from her own child, and can suckle it safely, even if the child has sores on the mouth, while a wet-nurse would be at once infected.

This is known as Colles's law.

The infectious stage in the congenital variety, like the acquired, lasts about two years, and is then followed by the tertiary period, which is in many respects similar to that of the acquired disease, the chief symptoms being deafness, lameness, blindness, and the formation of gummata.

The picture presented of a child of about fifteen with the signs of congenital syphilis well marked is as follows: A stunted, undersized child, with a pale,

earthy complexion ; the bridge of the nose is depressed, the forehead bossy, and the legs bowed forwards ; the eyes show white patches in the cornea, causing partial blindness ; there is deafness, which is incurable, and the teeth are decayed, the central upper incisors showing a curious black notch in the centre ; foul ulcers may be present in many parts of the body ; the voice is hoarse from ulceration of the palate, and the intellect defective.

Of course, all these lesions may not be present at once, but many patients presenting all these lesions are often seen in the wards and out-patient departments of our hospitals.

In the treatment of these cases two drugs have excellent effect. They are mercury in the primary and secondary stages, and iodide of potassium in the tertiary ; but, unfortunately, although in some cases the effects of these drugs are marvellous, yet a cure cannot be guaranteed, and there is always danger of the offspring being syphilitic.

CONGENITAL SYPHILIS.

(1) SCARS ON FOREHEAD AND ON LIPS.
(2) NOTCHED TEETH.
(3) EYE CHANGES.
(4) DEPRESSED BRIDGE OF NOSE.
(5) PROMINENT TEMPLES.

CHAPTER V

HÆMORRHAGE

Definition—Circulation—Varieties of hæmorrhage—Natural arrest of hæmorrhage — Treatment — Tourniquets — Hæmophilia — Hæmostatics — Saline infusion — Intermediate and secondary hæmorrhage—Treatment—Special arteries.

Definition.—By hæmorrhage we mean the escape of blood from the bloodvessels.

About 4 ounces of blood are pumped by each heart-beat into the circulation. The blood leaving the left ventricle of the heart passes into the aorta, the main artery of the body. Thence it passes through the large arteries into the smaller or arterioles, so into the smallest of the bloodvessels—the capillaries. The blood passing through these small vessels goes to every tissue in the body, and is then gradually collected into the small vessels or venules, thence into the large veins, and so back to the heart, where it enters the right auricle.

From the right auricle it passes through the opening into the right ventricle, then enters the pulmonary aorta, and passes through the lungs. Here again the arterioles break up into capillaries, which lie in the walls of the air-spaces of the lungs. The blood is gradually collected again, and passes back into the left auricle of the heart by the four pulmonary veins,

then through the opening into the left ventricle, and the circulation of the blood is complete.

In the aorta and arteries the blood is bright red in colour, the hæmoglobin, or colouring matter of the blood, containing plenty of oxygen. As the blood passes through the capillaries, the oxygen is given up to the surrounding tissues, and the blood gradually becomes dark and bluish in colour in its passage into the veins. This dark blood passes into the pulmonary aorta, and in the lungs the blood is again oxygenated and returns to its bright crimson colour.

The forcing of the extra 4 ounces of blood by each heart-beat into the arterial system is the cause of the pulse-wave that travels down the arteries, and which can be felt where the arteries are superficial—*e.g.*, the radial.

In the capillaries, however, the pulse-wave is lost, and the flow is continuous and steady, and in the veins the blood moves sluggishly along unaffected by the pulse-wave.

The pressure of the blood in the arteries is high, and the blood flows at the rate of half a mile an hour, but the flow in the capillaries becomes much slower, the area of the capillaries altogether being about 1,000 times that of the aorta. In the veins the rate of flow is slow, and depends on the contraction of the muscles to drive it onwards towards the heart.

To sum up: the blood in the arteries is bright red in colour, flows quickly away from the heart, is under considerable pressure, and the rate of flow is influenced by the pulse; in the capillaries the flow is slow and uniform; in the veins the blood is dark in colour, contains carbonic acid gas, the pressure is low, the flow is sluggish and towards the heart, and is uninfluenced by the pulse.

Anatomically, therefore, there are three kinds of hæmorrhage depending upon the kind of vessel that is cut—(*a*) arterial, (*b*) capillary, (*c*) venous—and it is important to quickly recognise with which kind one has to deal.

In arterial hæmorrhage the blood will be :

1. Bright red in colour.

2. Will spurt out of the vessels in jets corresponding to each heart-beat.

3. Pressure on the course of the vessel nearer the heart will stop or diminish the amount of blood escaping.

An exception will be a deep wound from which the blood cannot readily escape. In this circumstance arterial blood may flow out of the top of the wound evenly like venous blood, but it will still be bright red in colour.

In capillary hæmorrhage there will be a continuous oozing from a raw surface, and, as a rule, the bleeding soon stops.

In venous hæmorrhage the blood will be :

1. Dark in colour.

2. Will steadily well up in the wound.

3. Slight compression nearer the heart will increase the flow.

The arteries having much thicker walls than the veins and the blood pressure being much higher, it will require much greater force to stop arterial than venous hæmorrhage.

From a clinical point of view, there are two kinds of hæmorrhage to be considered :

(*a*) External. (*b*) Concealed.

In external hæmorrhage the blood flows away from the surface of the body or from one of the natural orifices, and is plainly seen.

In concealed hæmorrhage bleeding takes place into one of the cavities of the body, and the diagnosis must be made without the blood being seen. The signs will be local and general, and it is essential that every nurse should be able to suspect the presence of concealed hæmorrhage, as it may occur after any operation, and if so, the sooner the surgeon is called the better. The local signs are discovered by physical examination, but the presence of hæmorrhage should be suspected if the patient presents the following symptoms:

1. Increasing pallor of the skin and mucous membranes. (blanched)
2. Soft, full pulse increasing in rapidity.
3. Respiration quickened and sighing in nature.
4. Restlessness and attacks of vomiting.
5. Attack of syncope (fainting) and loss of vision.
6. Dilated pupils and sweating.
7. Subnormal temperature.

If these signs are noticed in a patient after an operation, the surgeon should at once be informed. Concealed hæmorrhage may occur into the peritoneal cavity, the pleural cavity, the stomach, the intestines, the bladder, or rectum.

Natural Arrest of Hæmorrhage.—Nature arrests hæmorrhage by two processes—one local, the other general; and the local process occurs in two stages—temporary and permanent.

1. **Temporary Arrest of Hæmorrhage.**—An artery has three coats—an outer, made of fibrous tissue;

a middle, of muscular tissue; and an inner, of elastic tissue. The outer coat is connected with the surrounding tissues, and when an artery is cut across the muscular coat *retracts* inside the outer coat, and the inner coat curls up and retracts inside the middle coat, thus diminishing considerably the lumen of the artery. At the same time, the stimulus of the injury causes the circular muscular middle coat to *contract*, and this still further diminishes the lumen of the tube.

When blood escapes from a bloodvessel, one of its fluid constituents (fibrinogen) undergoes a curious change and becomes insoluble (fibrin); this is known as the clotting of blood, the fluid blood becoming a semi-solid. This clotting of the blood occurs at the mouth of the cut artery, and extends a little way up the vessel, plugging it up with a semi-solid material.

The temporary arrest of hæmorrhage is due to contraction and retraction of the coat of the artery, and the plugging up of the mouth of the vessel with blood-clot.

The permanent arrest takes place by complete obliteration of the vessel in the fibrous tissue which goes to heal the wound and join the two cut surfaces together (see healing of wounds, p. 38), and the blood-clot takes no active share in this final arrest.

Hæmorrhage is arrested locally in this way, but at the same time the general condition of the patient assists. As a patient loses more and more blood, the blood-stream becomes slower and smaller by the weakening of the action of the heart. The pressure of the blood in the vessels falls, and at the same time the blood tends to coagulate more and more quickly. If the patient faints, the heart-beat is extremely feeble and the flow almost stops, so that coagulation will

be able to readily take place and the clot will not be dislodged by the blood-stream. For this reason stimulants should not be given in hæmorrhage unless the artery is securely tied.

Treatment.—First Aid in Arterial Hæmorrhage.

1. Elevate the part—especially if hæmorrhage is from a limb—so that the blood has to run uphill.

2. Quickly and thoroughly expose the wound and press into it a piece of linen, lint, handkerchief, etc., clean and aseptic if possible, but think *first* of arresting the hæmorrhage and secondly of asepsis.

3. Control the circulation in the artery by pressure of the thumb of the other hand in the course of the artery, taking care to press the vessel against a bone, and not against soft parts. The special points at which to compress each artery will be given later (p. 90).

All arterial hæmorrhage, however severe, can be controlled by observing the above rules. Pressure can be kept up for ten minutes or a quarter of an hour, during which time preparations can be made for more safely securing the artery.

A graduated compress of pieces of lint should be made, the smallest piece being the size of the wound, and resting in it, then several other pieces, each slightly larger than the last, should be laid on the top, and all secured by a bandage. This graduated compress should be as aseptic as possible, and may be soaked in antiseptic before being applied (see treatment of wounds, p. 90).

Tourniquets are instruments for compressing the artery above the wound, and the ideal tourniquet

should exactly imitate the action of the thumb—that is, it should press upon the artery only, not on the accompanying vein or any other part of the limb.

If no proper tourniquet is at hand, one can be improvised from a handkerchief and a piece of stick. A stone, or bandage, or a piece of wood is placed on the selected part of the artery. The handkerchief is tied over this and round the limb, and then, with a few turns of the stick thrust through the handkerchief, sufficient pressure is made to stop the flow of blood entirely.

Special forms of tourniquet are:

1. **Esmarch's Elastic Tourniquet.**—This consists of a piece of stout elastic tubing, into one end of which a hook is fixed, and at the other a short chain. The tourniquet is wound tightly round the limb, and the hook fixed to one of the links of the chain. It has the advantage that no anatomical knowledge is necessary for its application, so that it can be used by anyone. Its disadvantages are that it compresses all the structures of the limb, nerves, and veins as well as the artery, and that considerable strength is necessary to apply it tightly enough. It is mostly used as a means of controlling hæmorrhage during amputation and other operations, and can then be deliberately applied.

This plain elastic tube has been modified by passing it through a hole in a piece of box-wood in which a groove also has been cut. The wood is placed in the line of the artery, the elastic tube stretched over the limb and fastened by introducing it into the groove. The artery is the principal structure compressed if

the wood is placed in the proper position, and the tourniquet is very easy to apply.

2. **Petit's tourniquet** was invented in 1718. It is a webbing band which goes round the limb, and is fastened with a buckle. To this band is attached a pad, which can be clamped down on to the artery by means of a thumb-screw.

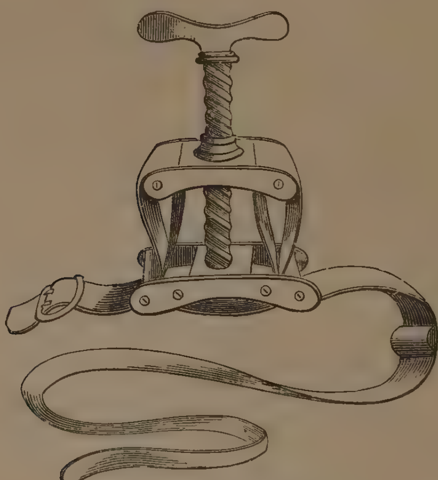


FIG. 5.—PETIT'S TOURNIQUET.

The pad must be adjusted over the line of the artery, and in such a place that pressure can be made against a bone. It is not suitable for quick application to arrest hæmorrhage, and for amputations it has now given place to the elastic tourniquet.

3. **Signoroni's and Lister's tourniquets** are metal instruments provided with a pad and thumb-screw. The former is used for the femoral artery,

and the latter for the abdominal aorta. They are seldom used by the modern surgeon.

The longest time that a tourniquet may be left on a limb is two hours; if left longer than this gangrene may occur, and the actual time should be as short as possible, as the patient suffers intense pain in the limb, owing to the constriction of the nerves and bloodvessels.

Fig. 6.—Signoroni's Tourniquet.

The special points to be noticed are:

1. That the tourniquet is applied tightly enough, otherwise the vein and not the arteries are compressed, and the bleeding is increased.

2. That the tourniquet should never be used for venous hæmorrhage.

3. That it is only to be used when the bleeding is from a vessel in one of the limbs.

4. That it must not be left on longer than two hours.

A surgeon usually arrests hæmorrhage by seizing the bleeding vessel in Spencer Wells' or some other kind of artery forceps, and the application of a ligature.

In exceptional circumstances a nurse would be quite justified in adopting this method and seizing the artery with forceps till aid arrived.

Venous Hæmorrhage.—The natural arrest of hæmorrhage occurs in veins in the same way as in arteries, but, owing to the thinness of the walls of the veins, retraction and contraction are not so marked.

On the other hand, the formation of the clot takes place more readily, the blood-stream being so much slower.

Venous hæmorrhage is most common in connection with varicose veins of the lower extremities—an exceedingly common complaint, especially in women. In this condition the veins not only become thin, and therefore liable to rupture, but they are firmly fixed to the surrounding fascia and skin by the formation of new fibrous tissue. This fixation prevents the retraction and contraction—the veins are held open, and hæmorrhage is often severe enough to endanger life.

Hæmorrhage also occurs from these veins, due to ulceration, which frequently complicates this condition, and the veins may be opened without the slightest warning, and without the patient feeling pain. The general symptoms will be those of concealed hæmorrhage, but at first the blood may not be noticed, and a considerable amount may be lost before the patient's attention is attracted by discovering a pool of blood. Want of knowledge of the proper treatment, and confusion caused by the sudden discovery of the amount of blood lost, may lead to the death of the patient.

In cases of venous hæmorrhage the limb should be immediately elevated; if the lower extremity, the patient should be put flat on his back, with the leg well in the air. All constricting bands—*e.g.*, garters—should be removed. Often all hæmorrhage will then cease. A graduated compress, starting with a pad a little larger than the wound, should be fastened over the bleeding point with a bandage. The limb should then be bandaged from the extremities up to the wound, so that there is no congestion of the veins

below the seat of injury. Elevation and a pad will always control venous hæmorrhage, and, as stated above, a tourniquet should never be used.

Capillary hæmorrhage is rarely dangerous, and should be dealt with by the application to the wound of various drugs called **hæmostatics.** These drugs cause marked contraction of the bloodvessels, and so aid Nature to arrest the flow of blood. Some of these can nearly always be obtained, the first three in the following list being particularly useful in emergency, whilst the others are frequently used by surgeons to arrest this class of hæmorrhage.

1. Hot water; temperature 115° F.—*i.e.*, the back of the hand can just be borne in it.
2. Cold water or ice.
3. Turpentine.
4. Tincture of iron.
5. Thyroid extract.
6. Adrenalin or suprarenal extract.

Capillary hæmorrhage can also be arrested by pressure, and it is only in people suffering from a peculiar congenital disease called hæmophilia that this form of hæmorrhage causes anxiety.

Hæmophilia is a family disease, the members of the family being often called bleeders; they are liable to severe and prolonged hæmorrhage from such slight accidents as the removal of a tooth or a cut from a penknife. The blood persistently oozes away from the cut surface in spite of pressure and elevation, and the application of the most powerful hæmostatics. Spontaneous hæmorrhages may also occur from the nose, mouth or kidneys, putting the patient's life in

jeopardy, and also into the joints, seriously crippling the subject of the disease.

Although a family disease, it rarely shows itself in the females, but they, curiously enough, transmit the complaint to their children, whilst the males who suffer from the disease itself generally have healthy children, and the disease stops. Should it occur on the female side, the onset of menstruation must be carefully watched, as the hæmorrhage then occurring from the uterus may be fatal. The disease tends to spontaneous recovery as the patient gets older, but death has been known to occur at the age of eighty from this complaint. All surgical operations, even the most trivial, except those to save life, are contra-indicated in these families, and death may result as a consequence of neglect of this rule.

The methods of arresting hæmorrhage are the same as those employed for normal people.

Jaundice.—In this condition the arrest of hæmorrhage is more difficult than in normal people. Wounds in patients who are severely jaundiced tend to continue to ooze from the capillaries that have been cut.

Calcium chloride is frequently given to these patients before and after operation, so as to counteract the tendency to hæmorrhage.

Treatment of Concealed or Internal Hæmorrhage.—This, as has been stated above, demands the presence of the surgeon, but till he arrives the following treatment should be carried out :

1. The patient should be kept lying down, with the end of the bed or couch elevated, so that the brain is the most dependent part of the body.

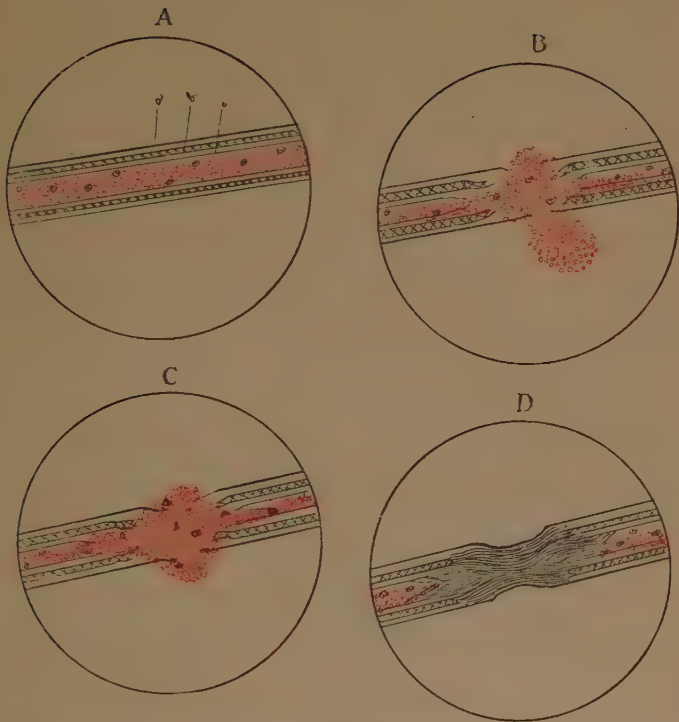


DIAGRAM OF TEMPORARY AND PERMANENT ARREST OF HÆMORRHAGE.

A. Normal small artery : *a*, outer coat, adventitia ; *b*, middle coat muscular ; *c*, inner coat, intima.

B. Artery torn across. Retraction of middle and inner coats ; contraction of muscular coat.

C. Clotting of blood outside and inside the vessel ; temporary arrest.

D. Obliteration of the lumen of the vessel with fibrous tissue ; permanent arrest.

To face page 86.

2. The limbs should be carefully bandaged from their extremities to the trunk.

3. A tight binder should be put on the abdomen.

All these methods are designed to keep up a good blood-supply to the brain, as this is essential to life.

Stimulants should never be given, as by increasing the force of the heart-beat they may restart a hæmorrhage that has ceased spontaneously.

Methods of Treatment of the Loss of Blood after the Hæmorrhage has been Arrested.—The patient is now suffering from loss of fluid from the body, and this will show itself in the symptom of thirst.

1. Fluid should be given by the mouth in the form of eggs and milk, as much as the patient will drink, unless contra-indicated by the blood having come from the stomach or other part of the alimentary canal.

2. **Saline** fluid may be injected by the surgeon into the veins—*i.e.*, **intravenous infusion.** If this is decided upon, the left forearm of the patient at the bend of the elbow should be cleaned as for operation, and the following instruments prepared and sterilized: Infusion apparatus—*i.e.*, syringe, cannula, indiarubber tubing, a pair of dissecting forceps, a scalpel, a silk ligature on an aneurysm needle, a pair of scissors, and a thermometer. At least 6 pints of boiled water at a temperature of 105° F. must be got ready, each pint containing a drachm of common salt.

The operation is done without an anæsthetic, and afterwards the vein is tied, and a small aseptic dressing is applied.

3. Saline fluid may be injected into the loose tissue of the groin or under the breast with a large syringe.

So far the form of hæmorrhage that has been discussed has been that known as primary hæmorrhage—that is, the hæmorrhage that occurs directly an artery is cut across. There are two other forms of hæmorrhage to be considered: **intermediary and secondary.**

Intermediary Hæmorrhage.—At the end of any severe operation the patient is in a condition of shock (see p. 93), the heart is acting feebly, and the blood-stream is sluggish. Hæmorrhage, therefore, will be slight from severed vessels, and soon cease. As the patient recovers from the condition of shock, the heart-beat gets stronger and stronger, and the blood-stream more forcible, so that clots formed in the mouth of vessels may be washed out and hæmorrhage restarted.

This is also aided by movements of the patient, which may even cause the slipping of a badly-tied ligature. This form of hæmorrhage is known as intermediary, and usually occurs within twenty-four hours of the operation.

The treatment does not differ from that of primary hæmorrhage. As soon as it is seen or suspected that intermediary hæmorrhage is occurring, either from the appearance of blood on the dressing, or from the general condition of the patient, the surgeon must be sent for, and till his arrival the suitable treatment of hæmorrhage should be carried out, dealing with it precisely as if it were primary hæmorrhage.

Secondary hæmorrhage, once so common, is seldom seen nowadays. It occurs after an operation when the wound has been infected and suppuration has occurred, and is not seen before the second or

third day. After that it may be seen at any time until the wound commences healthy healing.

It is most commonly seen after amputations, and is due to the breaking down of the blood-clot in the vessels under the action of the micro-organisms that are causing suppuration in the wound.

Secondary hæmorrhage is then to be feared in a wound in which large bloodvessels have been exposed, and which is suppurating, particularly in an amputation stump, with sloughing of the flaps.

In such a case as this the patient must be continually watched, and a tourniquet should be kept in a prominent place near the bed, so as to be ready for instant application. As a rule, warning will be given of the likelihood of severe secondary hæmorrhage by slight hæmorrhage occurring in the dressing, and the surgeon should be warned if this is the case. He will then take steps to render the wound more aseptic, and, as a rule, will elevate the stump. The stump should also be exposed, so that the bleeding can be at once detected, and, if it occur, pressure on the main artery should be made, a tourniquet applied to the limb, and the surgeon immediately sent for.

The treatment he will adopt will vary under different conditions, but probably it will consist of one of two methods: either he will open up the wound and secure the vessel on the face of the stump with Spencer Wells' forceps and then ligature it—and the instruments to do this should be got ready in the interval—or he will recommend an amputation higher up the limb.

Special Places to Compress the Arteries in the Treatment of Hæmorrhage.

Lower Extremity.—In all hæmorrhages from the lower extremity above the foot, the common femoral artery should be compressed just below Poupart's ligament against the pelvic bone, pressure being made backwards and a little inwards.

The point to be selected is midway between the anterior superior spine of the ileum and the symphysis of the pubis.

Foot.—If the bleeding be on the sole of the foot, pressure should be made on the posterior tibial artery midway between the prominence of the heel and the internal malleolus, pressure being made directly inwards.

If the bleeding be on the front of the foot, the anterior tibial should be pressed directly backwards, midway between the two malleoli.

Upper Extremity.—If the bleeding be below the axilla, the brachial artery should be compressed against the humerus as it runs along the inner border of the swelling of the biceps muscle. Pressure should be made outwards and backwards.

If in the axilla, pressure must be made on the subclavian above the clavicle.

This is best done with a door-key, or a piece of wood wrapped in a handkerchief, pressure being made from above downwards against the first rib.

In the palm of the hand bleeding can be arrested by placing a piece of cork covered by a handkerchief in the hand and bandaging the fingers over it. The limb should then be elevated.

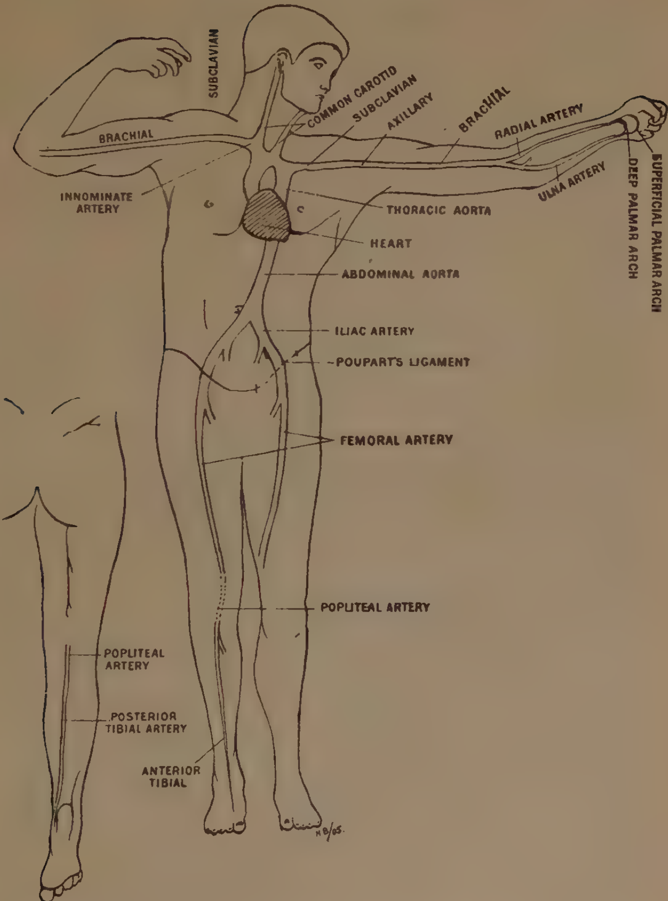


FIG. 7.—DIAGRAM OF THE MAIN ARTERIES OF THE BODY.

Head and Neck.—If the hæmorrhage occurs in the head and neck, the common carotid artery should be pressed backwards and slightly inwards against the

tubercle on the transverse process of the sixth cervical vertebra.

This process is found about 1 inch above the clavicle, and the artery can be plainly felt pulsating as it passes over it.

Epistaxis (*i.e.*, bleeding from the nose).—This is often exceedingly troublesome, and even dangerous, and may occur spontaneously, or be the result of injury.

The patient should be set upright, with the feet in hot water, and the head exposed to a cold draught by opening the window. Cold water and ice should be applied to the back of the neck and to the nose, to cause contraction of the bloodvessels. If these methods are not successful, or if the patient has lost a large amount of blood, it will be dangerous to keep him in the upright position, as fatal syncope may occur.

The patient should be kept lying down on one side, so that the blood readily escapes, and preparations should be made for plugging the nostrils. The nostrils are usually plugged with gauze, either from the outside or from the mouth behind the soft palate.

There is a special instrument—Bellocq's sound—made for plugging the posterior nares, but a good substitute is a soft indiarubber catheter, No. 8. This should be got ready for the surgeon, with a roll of white gauze and a stout piece of silk to secure the plug.

CHAPTER VI

SHOCK AND ASPHYXIA

Shock — Causes — Pathology — Symptoms — Prevention and treatment; Asphyxia — Causes — Symptoms — Treatment — Artificial respiration.

Shock and Collapse.—These are terms applied to a sudden depression of all the vital functions, showing itself chiefly in a diminution in the force of the circulation.

It may be the result of a direct impression on the central nervous system, or it may occur from acute hæmorrhage, or from septic infection.

Among the exciting causes of shock are:

1. Nervous causes—
   (*a*) Fright in connection with an accident, or fear of an operation, of which patients have died before the surgeon has touched them.
   (*b*) Injury to brain or spinal cord.
   (*c*) Peripheral irritation, as from renal colic, or irritation of the skin in burns and scalds.
2. Septic poisoning—*e.g.*, rupture of an appendix abscess into the peritoneal cavity.
3. Hæmorrhage, internal or external.
4. Exposure to cold or immersion in water.

Shock is partly due to mental and partly to physical causes: its severity is thus materially influenced by

the mental and physical condition at the time of the injury.

The above exciting causes will therefore act more strongly under certain conditions, which are called predisposing causes. These include obesity, youth, old age, alcoholism, the hysterical temperament and heart disease; and in patients with one of these predisposing causes present, shock is likely to be severe and fatal, and must be specially guarded against both before and after operation.

The severity of shock is in some measure proportionate to the degree of pain attendant upon an injury, and as sensibility to pain varies greatly in different individuals, so will the attendant shock be greater in some than in others; but it must be remembered that great shock may be present without pain, as is seen in cases after operation under anæsthesia.

Pathology.—This is not quite understood, but there is an interference with the circulation leading to weakening of the force of the heart and collection of the blood in the veins, especially those of the abdomen, whilst the brain is left anæmic. It has been described that the patient has bled into his own abdominal veins.

The symptoms vary in severity. In a bad case
1 the patient is semi-conscious; the pulse is feeble, 2
frequent, and hardly perceptible at the wrist; the
3 breathing is shallow; temperature subnormal; the 4
5 face is pale, bluish in colour, and covered with a cold,
clammy sweat, and the nose is cold. Nausea and
6 vomiting may be present. The pupils are dilated, and 7
there may be incontinence of urine and fæces. In some

cases of shock, instead of showing mental inactivity and apathy, the patient is restless, excited, and uncontrollable, although the pulse is irregular and weak. This is known as **erythritic shock,** and is seen frequently in children suffering from burns.

Prognosis.—This, of course, is very variable, and no definite statement can be made, but recovery, if it occurs, is usually complete. In some cases secondary phenomena may present themselves, but these are usually due to actual lesion of the central nervous system.

Treatment, Preventive.—Before operation, if shock is anticipated, the patient should be given an
1 injection of strychnine, $\frac{1}{30}$ or $\frac{1}{60}$ grain. He should be cheered as much as possible, and should not actually be prepared for operation till the last minute, so that the period of waiting is short. Care must be taken
2 that he is warmly wrapped up, hot-water bottles should be put on the operating-table, or, if a child, the operation should take place with the patient on a water-bed. In children especially, but also in all feeble patients, the extremities should be well wrapped up in cotton-wool.

During the operation more strychnine, or an injec-
3 tion of brandy, 1 to 2 drams, will be given if necessary, and these should be put out ready on the anæsthetist's table.

After the operation the patient should be returned to bed as quickly as possible, surrounded by hot-water bottles, and wrapped in a warmed blanket.

4 A coffee and brandy enema—black coffee 6 ounces, brandy 2 ounces, or $\frac{1}{2}$ pint of hot saline solution, with brandy 2 ounces—should be injected into the

rectum, and one of these should have been got ready before the operation was started.

If the patient is in much pain, an injection of morphia will probably be ordered, and if the loss of blood has been severe, or the condition grave, oxygen will be given.

Oxygen is supplied in long iron cylinders, and there is an indiarubber tube leading from the cylinder and connected with a mouthpiece, which is held near the patient's nose and mouth.

The oxygen should not be given straight out of the cylinder, as it is then extremely cold, but should pass through a Leiter's coil (see p. 27), which is lying in hot water. In this way the oxygen is warmed before the patient inhales it. Another method is to pass it through hot water contained in a bottle. In more extreme cases still the surgeon will give an intravenous injection of saline fluid, as described in the treatment of hæmorrhage, or will infuse saline fluid continuously into the subcutaneous tissue.

Continuous infusion or transfusion consists of introducing saline fluid (temp. 110° F.) into the subcutaneous tissue by means of a syphon.

The saline fluid is kept in a large glass bowl, which in its turn is kept in a bath containing hot water, so that the temperature inside the bowl does not fall below 110° F. The fluid is syphoned out by means of indiarubber tubes, which are fixed to two needles.

To give continuous transfusion the skin of the front of the patient's thigh should be cleaned as for an operation, and all the tubes and needles sterilized. Four pints of saline fluid are put into the glass bowl, and a thermometer adjusted so that it hangs well into

the fluid. The temperature at first should be 115° F., to allow for cooling. The needles are securely fastened on to the tubes, and the fluid is then drawn up by means of the indiarubber ball fitted to the tubes, and whilst it is running through the needles they are thrust well into the subcutaneous tissue of the thigh and secured by strapping. The fluid will then pass by syphonage from the bowl into the patient's tissues.

Not more than a pint of fluid should be allowed to run in in an hour, and the total amount usually injected is 8 to 12 pints. Sometimes infusion is continued for days.

Whilst the fluid is running the nurse should pay attention to the following points :

1. To keep the patient covered and warm.

2. To watch that the needles are not pulled out, or the tubes pulled off the needles by the movements of the patient. If they are they should be replaced.

3. To maintain the temperature of the saline fluid. This is done by adding hot water to the outside bath, and removing the cold. This point will need constant attention.

4. To add fresh saline solution to the bowl as required.

5. To note if the fluid is running in too quickly. This will show itself by great œdema (swelling) round the needles, and the infusion must then be stopped till the œdema has disappeared.

Sometimes serious symptoms—of which the chief are sudden heart failure, cyanosis (blueness) and restlessness—arise.

The infusion should then be stopped by clipping the tubes, and the surgeon sent for. The needles should not be removed.

After the infusion is over the needles are removed, and the small punctures closed with collodion.

In cases of shock met with in ordinary life, and not due to operation, the treatment is the giving of stimulants and getting the patient warm, but in the giving of stimulants in these cases two rules must be constantly remembered :

1. Stimulants must not be given if the shock is due to hæmorrhage and the bleeding vessel has not been firmly secured, otherwise the bleeding may be restarted (see p. 80).

2. Stimulants must not be given by the mouth if the cause of the shock is some abdominal injury or disease, for in these cases the stomach may be ruptured, or there may be a gastric ulcer which has perforated, and the stimulant will then be poured straight into the peritoneal cavity.

The stimulants commonly employed are brandy or other form of alcohol by the mouth, and subcutaneous injection of ether or strychnine.

Asphyxia or suffocation is due to the want of oxygen, and is seen in drowning, strangling, hanging (not judicial), carbonic oxide poisoning (fires), carbonic acid gas poisoning, chloroform poisoning, foreign bodies in trachea, etc.

The symptoms, if due to sudden closure of the air passages, may be divided into three stages :

1. Stage of increasing dyspnœa. This lasts about a minute, the respiratory movements become longer and stronger, and the pink colour of the lips darkens and gives way to bluish-purple.

2. Convulsive stage. This also lasts about a minute, and the respiratory movements become violent and

Continuous Infusion with normal Saline Solution.

convulsive, the heart beats forcibly, and the dusky colour of the lips is increased.

3. Stage of exhaustion, which lasts two to three minutes. The respirations become shallow and less frequent, finally ceasing. The heart beats feebly and infrequently, and the dusky lips become pale and anæmic. Death occurs.

In the present paragraph the treatment of asphyxia due to drowning or foreign bodies in the throat will be given. For asphyxia during and after anæsthesia, see p. 131.

Rescue from drowning is generally successful when the time of immersion is under four minutes, but recovery must always be presumed possible, even although the patient has been under water for a quarter of an hour.

Treatment.—1. Loosen all things round the neck and chest.

2. Force open the mouth with a piece of stick, remove all mud, weeds, false teeth, etc.

3. Prop the mouth open and pull the tongue forwards if possible. Secure the tongue with a bandage.

4. Turn the patient on his face so that the water can run out of the mouth.

After these preliminaries several methods of artificial respiration may be tried. The following to be described are Sylvester's and Schafer's.

Sylvester's.—1. Place the patient on the back, with a pillow (folded-up clothes) under the shoulders and with the head hanging back.

2. Grasp the arms above the elbows, standing or kneeling behind the patient.

3. Press the elbows firmly against the sides of the

patient, compressing the chest, and then slowly raise them above the head, pulling strongly on them so that the chest is expanded.

4. Lower the arms deliberately, and again press them firmly against the chest. An assistant at this stage should push the stomach and liver up to raise the diaphragm from below.

It is important that these movements should be carried out deliberately and firmly, about fifteen to twenty times a minute. In children the rate should be faster, till in an infant it is thirty to forty times a minute, but even then the movements should be deliberate and not jerking.

In **Schafer's** method the patient is put lying on the face, taking care that the mouth and nose are clear.

A hard pillow is placed under the epigastrium, and pressure with the whole weight of the body is made on the tenth rib. This compresses the chest, and on relieving the weight, it springs back to its normal position, owing to the elasticity of the ribs, and so the movements of expiration and inspiration are carried out. The movements should be done at the same rate as in Sylvester's method.

If possible, supplement artificial respiration by the giving of oxygen (see p. 96). After breathing is re-established, cease the artificial respiration, wrap the patient in warm blankets, and carry out the treatment for shock.

Secondary Asphyxia.—It is important that the patient who has been suffocated should be kept lying down for some hours, better a day, after recovery. In some cases in which the patient has been allowed to

get up and walk soon after recovery all the symptoms of asphyxia have returned, and the patient has died. This secondary asphyxia, should it occur, requires the same treatment as the primary.

If the asphyxia is due to a foreign body introduced through the mouth, this should be forced open and the finger thrust to the back in the hope of removing the obstruction. If this is unsuccessful, the patient may be inverted and the procedure tried again. If still unsuccessful, tracheotomy will be necessary, and until this can be done artificial respiration should be carried out.

Recovery from asphyxia is possible in apparently hopeless cases, and artificial respiration should be steadily maintained until life is pronounced extinct by the surgeon.

CHAPTER VII

NEW GROWTHS

Definition—Innocency—Malignancy—Secondary growths—Treatment—Cause—Sarcoma—Carcinoma.

Definition.—A new growth is an atypical new formation not the result of inflammation.

An understanding of the nature and the effects produced by these new growths is essential to an intelligent comprehension of surgical nursing, as a large part of the work in a surgical ward is the treatment of these growths and the complications that arise from their presence; and this treatment differs in one important respect from that of inflammatory conditions.

In the treatment of tumours, rest, which is the principle of treatment of inflammation, is useless. Tumours grow steadily, whether they are kept at rest under the best possible hygienic conditions or not, and this is such a constant feature that one of the methods of diagnosing between tumour formation and inflammatory conditions is to watch the effect of rest and the other remedies of inflammation on them. Tumours increase in size under the conditions that benefit inflammatory swellings, and the only remedy for them is removal at the earliest possible moment.

New growths imitate in their structure pre-existing tissue, such as glands or muscles, and they can only

occur where the tissue which they imitate is found; thus a bony tumour (osteoma) can only grow from a bone, it cannot grow from a gland or muscle; a tumour imitating skin can only grow from the skin, and so on. This mimicry of structure, although often very exact, is not quite perfect, and the more rapidly the tumour grows the more imperfect is the mimicry—that is, the tumour is *atypical* in structure. Slight or marked differences can always be found between a tumour and the tissue it resembles, and, above all, it fulfils no function; it is useless. For example, a tumour resembling the glandular structure of the breast (adenoma) does not secrete milk, and there are no ducts to the surface of the body. Another important difference between normal structures and new growths is that the latter grow independently of the rest of the body, and one sees cases of tumours increasing rapidly in size, while the rest of the body is wasting. In this connection it is interesting to note that tumours contain no nerves, and so are not under the trophic control (see fractured spine) of the central nervous system.

Although tumours contain no nerves in themselves, they press upon the nerves in the surrounding tissue, and so may give rise to pain.

The new growths (a term much less frightening to patients than the word tumour, and more correct scientifically) may be divided into two large groups—the innocent and the malignant tumours, of which the latter are much the more important.

An innocent growth is one that grows locally, and only displaces the tissues in its neighbourhood; it does not infiltrate them, no matter how large it may

grow. It never gives rise to secondary growths in other parts of the body, and it is shut off from the surrounding tissues by a strong fibrous capsule.

If such a growth is completely removed it never returns, and such removal is usually easy, as it can be readily shelled out of its capsule. Innocent growths only cause trouble by their position ; a bony tumour growing from the shin-bone is of no importance, and can be left alone, but should it be growing from the

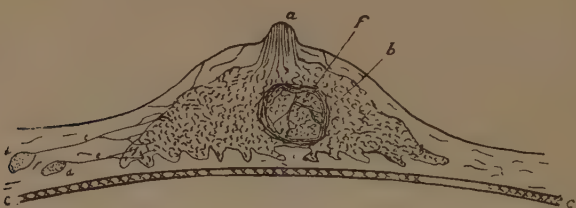


FIG. 8.—DIAGRAM OF AN INNOCENT GROWTH OF THE BREAST (ADENOMA).

a, Nipple ; *b*, breast tissue ; *c*, muscle ; *d*, lymphatic glands not enlarged ; *e*, lymphatic vessels ; *f*, adenoma in a capsule of fibrous tissue.

inner side of the skull-bones, it will cause pressure on the brain, and may lead to fits, paralysis, or even death.

A malignant tumour spreads itself into the surrounding tissues, not merely pushing them to one side, but invading them and taking their place. There is no capsule limiting the growth, and by means of the lymph and the blood-streams small particles of it can be carried either to the nearest lymphatic glands or to distant parts of the body. These small pieces, wherever they lodge, start growing, and reproduce the

original tumour, which is known as the **primary** growth, whilst the latter are known as **secondary** growths. It is the production of these secondary growths that gives the malignant tumours their dangerous characteristics, as an apparently successful removal of the parent growth may be quite useless, owing to the fact that secondary growths have already started in distant organs.

Local removal is also difficult, as, having no capsule,

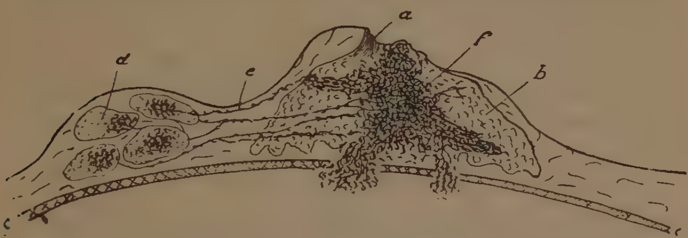


FIG. 9.—DIAGRAM OF A MALIGNANT GROWTH OF THE BREAST (CARCINOMA).

a, Nipple retracted; *b*, breast tissue; *c*, muscle infiltrated with growth; *d*, lymphatic glands enlarged; *e*, lymphatic vessel containing growth; *f*, carcinoma infiltrating skin, muscle, and lymphatics.

it is impossible to tell the exact limits of the tumour, which gradually shades off into the surrounding tissues. Small portions are easily left behind, which will form the nucleus for a recurrence of the primary tumour.

These facts explain the very extensive operations which are done for what may seem a comparatively small tumour, for extensive local removal is the only means of insuring success.

As an example of an innocent tumour, the adenoma

of the breast may be taken. This tumour grows in the breast substance, but is completely shut off from the normal tissues by a fibrous capsule, inside which it lies.

Although it may grow to a very large size, it does so slowly, and causes little inconvenience to the patient beyond the fact of its presence and its weight. If it be operated upon, it is very easily removed from the breast tissue, and the operation is quite a trivial one. The lymphatic glands in the axilla are not affected, and are left untouched by the operator, and if the removal has been complete, it never recurs.

For the typical course of a malignant tumour the breast can again be taken, the common malignant growth being called a carcinoma or cancer.

This form of tumour generally begins to grow in the breast of a woman about forty or fifty years old, and is quite painless in its onset. As a rule, it is only discovered by accident, either by the patient feeling something hard in the breast whilst washing, or some slight pain may lead to an examination. As it causes only very slight pain and inconvenience, little notice is, as a rule, taken of it, the patient hoping it is nothing serious, and that it will disappear. This neglect to show the surgeon a tumour directly it is discovered is one of the gravest obstacles to efficient treatment, time after time the patient coming too late for any hope of successful removal, and only asking for assistance when the condition can no longer be concealed, and when radical cure is impossible.

The tumour, instead of growing inside a capsule, sends out processes into all the surrounding breast tissue, and the older surgeons, noticing the hard central mass with its outlying processes, likened it to the

body of a crab, with its outstretching limbs, and from this they gave it the name of cancer (a crab).

Some of the processes creep along the lymphatic channels until they reach the axillary lymphatic glands, which become enlarged and hard by the presence of secondary growths, whilst others grow up to the nipple, and by their contraction gradually pull upon it until it is retracted into the breast tissue.

Soon the patient finds she is losing weight, strength, and energy, and passing into an enfeebled, anæmic condition known as **cachexia**, and being alarmed, goes to her doctor, only to find that the growth has spread into the muscles and tissues beyond the breast, and that she is doomed to death, operative treatment being hopeless.

If it still be left alone the cancer invades the skin, and then ulceration occurs, so that, added to the presence of the tumour there is a large, foul ulcer. Septic absorption takes place from the surface of the ulcer, the cachexia increases, and the path is rapidly downhill. Small portions of the tumour also get into the blood-stream, and are carried to various parts of the body, where they lodge, and form the nuclei of secondary deposits. These deposits, following carcinoma of the breast, are particularly common in bones, and especially in the bones of the spinal column, which fall together as they are invaded by the growth and so form an angular projection in the back.

When these secondary growths have occurred, local removal of the tumour is useless, and should not be done except as a palliative measure to relieve the patient of a foul-smelling ulcerating mass.

The only treatment of such a tumour as has been described is free and early removal of the whole breast, the skin over it and the whole of the lymphatic system of the breast and the axilla, and it is only by this extensive operation, done at an early date, that the patient can be safeguarded against recurrence.

Besides causing death in this way by cachexia and secondary deposits, new growths can terminate life by obstructing the lumen of one of the canals of the body, the patency of which is essential to life.

As an example of this, carcinoma growing in the wall of the œsophagus may be taken. The new growth, spreading and ulcerating in the wall of the tube, will gradually close it by contraction of the new tissue till no food or liquid can pass. In the early stages of the disease the patient experiences no pain, only an increasing difficulty in swallowing his food. At last he finds that solid food cannot be taken at all, and that he is compelled to live on fluids, while at the same time he is rapidly losing weight. Finally, even fluids cannot be taken; the growth has completely blocked the tube, and starvation stares him in the face.

A tumour in the œsophagus is rarely amenable to radical surgical treatment, and the only method of relieving the condition is by performing the operation of gastrostomy—*i.e.*, the making of a permanent opening into the stomach through the abdominal wall, by means of which the patient can be fed.

This operation merely prolongs life; it does not cure the disease, the patient dying in a short time of cachexia and secondary growths, a fate, however, that is preferable to slow starvation.

The cause of tumour formation is quite unknown, in spite of the many able men that have tried, and are trying, to elucidate the mystery. Some cases follow a blow or injury, such as a fracture; others seem to depend upon the presence of a chronic source of irritation, such as cancer of the lip or tongue occurring in smokers, especially those using short clay pipes; but for many tumours no predisposing or exciting cause can be found.

Tumours occur all through the animal kingdom, and analogous diseases are found in the vegetable world. Civilized races seem more liable to them than the savage races; and it appears that malignant tumours are on the increase among the more highly-cultured people, though this is somewhat doubtful, as the increased number of people certified as dying of malignant disease may be due to improved methods of diagnosis rather than to actual increase of the cases.

Theories have been advanced that tumours are due to the eating of meat or to the action of micro-organisms, but these lack confirmation. In many cases they are hereditary, but this is not necessarily the case.

The malignant growths are divided up into two great classes, according to the nature of the cells that go to form them.

If the tumour grows from the essential cells of an organ—for example, the milk-secreting cells of the breast—and is composed of cells resembling normal breast cells, it is called a *carcinoma*; but if it grows from the connective tissue—*i.e.*, the packing material holding the glandular substance together—it is termed a *sarcoma*.

The carcinomata usually grow towards the end of middle life, and are rarely seen before the age of thirty. They spread along the lymphatic channels, and the glands are quickly involved, and become hard and enlarged. Spreading by the blood-stream is later, and death will often terminate the scene before this mode of dissemination takes place.

Carcinomata may be classified according to the amount of fibrous tissue they contain; if much, they are stonily hard, and are known as scirrhus; if a little, they are soft, and are called encephaloid (brain-like). Carcinomata that grow from the epithelium of the skin or of a mucous membrane are usually termed epitheliomata.

The sarcomata occur, as a rule, in young subjects, some cases even being congenital (present at birth). They are, on the whole, more rapidly growing and more fatal than the carcinomata, and are spread to other parts chiefly by the blood-stream. Early dissemination is common, and the secondary growths usually occur in the lungs, and so are beyond the reach of surgery.

At the present time the treatment of all tumours, both innocent and malignant, is removal at the earliest possible moment, although in a few cases innocent tumours that are not causing pressure on important structures may be left untouched.

Various other methods have been tried from time to time, but so far without much success; still, cases that are beyond the hope of successful operation may be treated by other methods.

The most successful of these methods is the light treatment, either by X rays or the Finsen light,

Rodent ulcer, a special form of epithelioma, has been treated by both these forms of light with a fair amount of success, and some cases of carcinoma are greatly benefited, but the light treatment should at the present time be considered secondary to complete removal by the surgeon.

Classification of New Growths.*

INNOCENT CONNECTIVE-TISSUE GROWTHS.

1. Osteoma (bone).
2. Chondroma (cartilage).
3. Neuroma (nerve).
4. Angioma, or nævus (bloodvessels).
5. Lymphangioma (lymphatics).
6. Lipoma (fat).
7. Odontoma (teeth).
8. Myoma (muscles).
9. Fibroma (fibrous tissue).
10. Myxoma.

MALIGNANT CONNECTIVE-TISSUE GROWTHS.

1. Sarcoma.
2. Endothelioma.

INNOCENT EPITHELIAL GROWTHS.

1. Papilloma (warts).
2. Villous tumours.

MALIGNANT EPITHELIAL GROWTHS.

1. Epithelioma.
2. Rodent ulcer.

INNOCENT GLANDULAR-TISSUE GROWTHS.

Adenoma { True. / Fibro. / Cystic.

MALIGNANT GLANDULAR GROWTHS.

Carcinoma { Scirrhus. / Encephaloid. / Atrophic.

* This classification does not aim at being scientific, but will be found to be useful clinically.

CHAPTER VIII

BURNS AND SCALDS

Definition—Classification—Prognosis—Symptoms—General Treatment—Baths—Local treatment—Skin-grafting—Rashes—Frost-bites—Symptoms—Results—Treatment—Chilblains.

Definition.—A burn is the application of dry heat sufficient to cause some destruction of the skin or mucous membrane. A scald is the action of moist heat to the same degree. Both being injuries to the tissue, will cause inflammation, and both require the same treatment.

With burns and scalds will be considered the action of the various acids and caustic alkalies on the skin, such as sulphuric acid and caustic soda.

Six degrees of burns are generally described, but the number can be limited to three.

First Degree.—Epidermis is scorched; there is redness of the skin and pain. No blebs form, and there is no scarring. Desquamation of the skin will follow.

Second Degree.—The epidermis is separated from the true skin by the formation of blebs or blisters containing a clear fluid. No scarring will result, but pigmentation of the skin will often remain for some time.

Third Degree.—The true skin is destroyed. If this occurs, scarring will result, healing taking place by the formation of granulation tissue, which turns to fibrous tissue, the epidermis growing over the granulations as in other wounds (see p. 39). It makes little difference except in the density of the scar and its contraction whether the true skin only is burnt or whether the limb is charred to the bone. Of course all three degrees of burns may be associated in the same patient.

Prognosis.—Burns are very fatal injuries, especially in young children and old people. They are more fatal if they occur on the abdomen and chest than if they occur on the limbs. Large superficial burns are more fatal than limited deep ones, recovery being rare if more than one-third of the body is burnt.

The symptoms that occur after burns are taken up in stages, so that the principles of treatment may be understood; but it must be taken for granted that all burns do not follow these stages exactly, and that the stages pass imperceptibly into one another.

First Stage.—Depression of the nervous system and congestion of the internal organs. This stage lasts about forty-eight hours, and death often occurs during this period. This condition is often called shock, but there is some other factor not clearly understood present with the shock. The larger and deeper the burn the longer and more dangerous the first stage will be.

Pain will be severe, especially if the burn be of the second degree, but in bad cases pain will be absent, the nervous system being too depressed to feel. The patient will often lie quite quiet, especially if a child,

but in other cases great restlessness may be present. The patient is cold and shivering, the temperature is subnormal, the pulse is weak and rapid, breathing shallow, and in children convulsions are common.

Towards the end of this stage vomiting and diarrhœa may occur ; both are bad signs, and may be the cause of death. The urine is scanty, and may contain albumen, or even blood.

Second Stage: Reaction and Inflammation.—The wounds caused by burns are always septic. There is a large amount of dead tissue for the micro-organisms to live on, and this dead tissue or *slough* must be separated by suppuration. During the separation of the slough severe hæmorrhages may occur and prove fatal. In this stage, which lasts from two days to about two weeks, the temperature will be raised, the pulse and respiration rapid, and the appetite lost, the patient suffering from the general malaise of septic absorption. Inflammation of the pulmonary system—*i.e.*, bronchitis and pneumonia—are common, and often cause death.

Third Stage: Suppuration and Exhaustion.—This stage lasts an indefinite time, depending on the amount of slough there is to be separated and the success or otherwise of the treatment. The exhaustion is due to the constant discharge of pus, the absorption of toxins, and the hæmorrhage that occurs from separation of the sloughs. Cellulitis, erysipelas, and pyæmia may occur.

Fourth Stage: Healing and Contraction of Scar—Healing will occur in precisely the same way as in other wounds, but the formation of scar tissue

is often greater, owing to the large surface affected, and the amount of contraction may be serious. Special methods must be adopted to counteract this contraction, which is to an extent useful, as it diminishes the distance that the epithelium has to cover in making the resulting scar smaller than the original wound; but if excessive, it will make the parts unshapely, and hideous deformity or impaired motion may result.

Treatment.—In the first stage the patient is in danger of dying from constitutional effects of the burn, and therefore the first treatment must be constitutional rather than local. The general condition must be treated first and shock combated.

In severe cases wrap the patient, clothes and all, in hot blankets, put him in bed with hot-water bottles, and give hot brandy and water, either by mouth or by rectum, the quantity varying according to the age of the patient.

Tincture of opium (laudanum) will usually be ordered to relieve the pain, and should be given with the brandy.

Brandy should continue to be given until the stage of shock is passed.

In extensive superficial burns, especially in children, a warm (96° F.) bath, made of boracic acid, 10 drams to a gallon of water, is most useful, the child being placed straight into it, and the burnt clothes soaked off. This relieves the pain and counteracts shock, but it should not be given if the child resents it or is restless. The time the patient should be kept in the bath depends upon its effect. If he is soothed by the hot water, and the temperature rises to normal, he may be kept in for hours, hot water being added from

time to time. If, on the other hand, the patient is restless and the pulse gets more rapid, he should be removed and put into bed in a warm blanket.

In removing a patient from the bath it is important to do it gradually, and to cover the burns with the local dressing as he is removed. Thus, if the arms and chest be burnt, one arm should be lifted from the bath and covered with dressing, then the second arm, and finally the patient supported half out of the bath and the chest dressed. All the burnt surfaces now being covered, the patient is removed, the rest of the body quickly dried, and the patient put into bed with hot-water bottles.

To sum up, the general treatment consists of warmth, stimulants, and opium.

Local Treatment. — *First Aid.* — The blisters should be cut with a pair of clean scissors, but the skin should not be removed. If the burn occurs in a private house, or away from surgical necessities, one of the following may be at once applied as a dressing to the burnt surface : Vaseline on linen, olive-oil, salad-oil, or butter without salt. If no oily substance is at hand, a saturated solution of sodium bicarbonate may be used, or the part sprinkled with flour. Carron-oil, once largely used in iron-works, etc., consists of equal parts of linseed-oil and lime-water, to which is added a little turpentine, and is useful.

If at hand, boracic or other simple ointment should be used. It should be spread on strips of lint, which can be removed piece by piece, so that not all the burn is exposed at the same time.

The first dressing should not be changed until the shock has passed off, otherwise great pain will be

caused and the shock increased. In changing, it is often useful to give a warm bath, and the dressing should always be removed piece by piece, putting on a fresh strip as soon as the old one is removed. Plenty of aseptic gauze should be put over the ointment so that all discharge is absorbed, and the dressing can be done less frequently. Cotton-wool is not good in these cases, as it will stick to the wound.

The simple boracic ointment dressing is all that is needful in most cases, but if the burn becomes very septic, boracic fomentations are useful to assist in the removal of sloughs.

In small, deep burns the surgeon may decide to give an anæsthetic, and clean and dress it like any other wound, but this is not often done.

When the surface is cleanly granulating, too frequent dressing is to be deprecated. It causes pain, and also interferes with the process of healing.

Water and fomentations are to be avoided, as they tend to make the granulations too abundant and anæmic.

Strong antiseptics are not necessary, and are even dangerous, from absorption taking place from a large surface.

The best treatment is to cover the granulating wound with sterilized oiled silk (it can be sterilized by boiling) in which numerous small holes have been cut. A layer of gauze is put on this, and then cotton-wool, securing all with a bandage. Such a dressing needs changing only every two or three days.

Contraction from burns is prevented by :

1. Careful splinting and rapid healing.
2. Plastic operations.
3. Skin-grafting.

Of skin-grafting there are several methods, but the one going by the name of Thiersch has practically superseded all others. It consists of removing long strips of epithelium from a limb and placing them over the granulating surface.

To Prepare a Patient for Skin-grafting.—The wound should be dressed with gauze, the surrounding skin being thoroughly cleansed, but strong antiseptics avoided. If possible, the skin on the inner side of the thigh should be selected for taking the grafts from, or the skin on the inner side of the arm. In both these places the skin is soft, pliable, and free from hair.

The selected area should be prepared as for an operation (see p. 127), but strong friction and powerful antiseptics should be avoided. During the operation antiseptics are not used by many surgeons, their place being taken by warm (105° F.) saline solution (1 dram to a pint), and this should be prepared. As a rule, the wound is not dressed for from three to five days after skin-grafting, otherwise the treatment is the same as for ordinary wounds.

Rashes after Burns.—Erythematous rashes (red rashes fading upon pressure) are common after burns, and in many cases are due to the absorption of toxins from the burnt surface. That is, they are due to sepsis, but there seems little doubt that scarlet fever is particularly liable to attack children suffering from burns. The germ of scarlet fever (which is unknown) is considered by some to enter through the wound instead of by the usual channel, the throat.

The nurse must carefully watch for a red rash in

burn cases, and the patient should at once be isolated until the opinion of a medical man can be obtained.

Frost-bite.—Definition.—Inflammation, due to excessive cold, often resulting in the death of the tissue.

Death of tissues from cold may occur in two ways, and in treatment it is important to bear them in mind.

Firstly, death occurs from the actual freezing of the fluids in the tissue, so that the circulation ceases. The part exposed to the cold becomes white and pulseless, and later will be separated as a slough.

Secondly, death takes place from excessive inflammation occurring whilst the tissue is thawing. On exposure to the cold, the part becomes white from contraction of the bloodvessels, but is not actually killed, only severely damaged. When warmth is applied, the contracted bloodvessels become widely dilated, and the part having been injured, inflammation occurs. The tissue becomes congested with blood, extravasation of cells and serum takes place, and if the reaction is very severe the part will die.

Symptoms.—Frost-bite is not often seen in this country, but it does occur, and a nurse should be able to recognise it, and apply the appropriate treatment.

The part exposed becomes ivory white and insensitive, and as there is no pain, the victim is not aware of the condition. If he now enter a warm room, the part becomes red, swollen, congested, and exceedingly painful, showing, in fact, all the signs of an acute inflammation. Later, the part will die, and will be separated as a slough, the extent of the slough varying from a small piece of skin to the whole of a limb or an ear.

Treatment.—Directly a part is noticed to be frozen, the circulation must be restored by friction, and, above all things, the introduction of the patient to a warm atmosphere must be gradual.

The part should be thoroughly rubbed with snow, if available, or with cold water till a reaction is set up and it is seen that the circulation is restored.

The patient should then gradually be brought into an atmosphere of normal temperature, but the direct application of warmth is never advisable.

Stimulants should not be given unless the patient is actually dying of shock and exposure, and in this case he should be wrapped in hot blankets, and alcohol given, but still the sudden exposure to warmth must be avoided. If gangrene occur—and this will usually be of the fingers, toes, or nose—the surgeon will operate directly it is seen how much of the part is actually dead, and this will be shown by a red line of inflammation between the dying and dead part. This inflammatory zone is known as the line of demarcation.

The further treatment will be like that of any other wound.

Chilblains (pernio) are mild forms of frost-bite, and are particularly seen in people whose circulation is imperfect, especially when this is associated with some nervous lesion, such as infantile paralysis.

The skin of the fingers or toes becomes red and inflamed, and itching is often intense. In severe forms vesication occurs, and then the blisters may burst, forming the condition known as broken chilblains.

Treatment consists of improving the general health by exercise, good food, and tonics, and the wearing of warm socks and gloves in cold weather.

Friction with camphorated oil or other stimulating liniment is good, and to relieve the itching equal parts of tincture of belladonna and soap liniment may be painted on.

For broken chilblains resin ointment is a good application.

CHAPTER IX

THE OPERATION

Preparation and after-treatment—Room—Furniture—Anæsthetist's table—Preparation of patient—Bed—Operating-table—The operation — After - treatment — Shock — Vomiting — Thirst — Flatulency—Aperients—Urine--Feeding—Peritonitis—Operations on children—Feeding—Aperients

In this chapter the nursing of a case of laparotomy, such as for a simple ovarian tumour, will be chiefly described ; but the general directions for the preparation of the room, the giving of aperients, etc., will apply to all cases of operation where special directions are not given, and where the condition of the patient is not one to cause grave anxiety.

Time of Operation.—The best time for operating is in the early morning about nine o'clock, so that the patient is not starved all day, and has no prolonged wait after the night's rest.

Room.—A room should be chosen with a south aspect and large windows, so as to have a good light, but at the same time care should be taken that an artificial light is quickly available in case of fogs.

The room should be prepared two days before the operation. All superfluous furniture and ornaments being removed, the carpet taken up, and the curtains

and blinds taken down if the room is not overlooked by neighbours. The room should be thoroughly cleaned and dusted. The walls and the necessary furniture should be wiped over with a cloth damped with 1 in 60 carbolic, and should be wiped over again on the morning of the operation, but should not be dusted then, and as few people as possible should be allowed to enter the room after it is ready, so that the dust is not disturbed.

Should the nurse only arrive on the morning of the operation, the room must not be too vigorously 'turned out,' as it is better to have undisturbed dust than dust floating about in the air at the time of operation. The furniture should, however, be damped with 1 in 60 carbolic, which will keep the dust down. A damp sheet spread on the carpet will prevent dust rising from it.

There should be a fire in the room, unless it be heated with hot water, and the temperature should be kept at 75° F. during the operation. The operation-room should be adjacent to the patient's bedroom, so that there is no difficulty in returning the patient to bed.

In some cases it is necessary to have the operation done in the patient's bedroom. If so, the same preparations should be made, and the bed pushed out of the way in one corner.

The following furniture is necessary :

Operating-table.
Four other tables.
Washing-stand, with two nail-brushes and soap-dishes.
Two chairs.
Two basins for sponges.
Two pails.

Operating-table.—This can be hired from nursing homes, instrument makers, etc., but one can always be extemporized from a stout kitchen-table—which must not be too wide—or two smaller tables joined together. For children's operations a low chest of drawers is often convenient, and in some cases planks of wood laid on trestles make an excellent substitute for the more costly hired table.

The table should be covered with two thicknesses of clean blanket, and then with a mackintosh, which must be comfortably warmed just before the patient is placed on it.

A small horsehair pillow in a clean pillow-case should be procured, and if for a neck or throat operation should be placed under the mackintosh. A double thickness of clean blanket is got ready to cover the patient with whilst being anæsthetized. Two mackintoshes are getting warmed ready to cover the patient with during the operation.

Four other tables are wanted, on which are placed :

1. Anæsthetic and the anæsthetist's apparatus.
2. Surgeon's instruments, lotions, and swabs.
3. Sponges in lotions.
4. Dressings.

1. **Anæsthetist's Table.**—If the nurse is preparing this, the following things should be put out :

Clover's inhaler and ether.

Rendle's mask and A.C.E. mixture.

Skinner's mask and chloroform (Junker's inhaler and chloroform for nose, mouth, and throat cases).

Dental prop.

Tongue forceps and Mason's mouth-gag.

Two sponge-holders and lint.
Two hypodermic syringes, one containing strychnine and the other brandy.

2. **Surgeon's Table.**—This should hold a tray containing the instruments, which may be covered with antiseptic lotion, or remain dry, according to the wish of the surgeon. A basin with antiseptic lotion for the hands—*i.e.*, carbolic 1 in 60, biniodide of mercury 1 in 500. This lotion should be comfortably warm. A small boiled tumbler for Spencer Wells' artery forceps is useful.

3. **Table for sponges,** to hold two clean basins (boiled if possible) filled with hot antiseptic lotion.

4. **The dressings,** unopened and untouched, are placed on the fourth table.

If an assistant be present, a fifth table for his lotion and swabs should be procured.

The tables should be covered with clean towels. It is, perhaps, unnecessary to point out that if the room be small the number of tables must be curtailed.

Washing-stand must hold two basins and a soap-dish. Two new nail-brushes are to be provided, although the surgeon will usually bring his own.

Two chairs, one for the anæsthetist, the second for the surgeon in some operations, such as removal of hæmorrhoids. In abdominal operations a chair is sometimes utilized to place the patient in the Trendelenberg position.

Two pails should be procured, one to hold dirty swabs, etc., the other for dirty water.

A continuous supply of fresh boiled water and of hot water must be arranged for, and (if there are no taps in the room) a person must be warned to bring hot water to the door on a given signal.

The nurse should also provide soap and a plentiful supply of clean towels.

All basins used must be thoroughly cleaned and rinsed out in boiling water.

In most private houses there is a copper in the kitchen, which may be used for boiling the basins and dishes in beforehand.

It is often very convenient to have a second room ready for the surgeon to give the preliminary washing to his hands, and where he can change his coat for his operating-clothes.

If possible, the patient should be kept in bed for two days before the operation, as she will then get accustomed to the restraint, and will take the anæsthetic better. The diet for the two days should be light and nutritious, and all things liable to cause flatulency—such as green vegetables, pastry, and much milk—should be avoided. Besides the ordinary daily bath, the abdomen should be well washed each day with hot soapy water, special care being given to the umbilicus and the folds of the groin.

Preparation of the Skin.—The evening before the operation the external genitals should be shaved—unless orders are given to the contrary—and the abdomen again well washed with soap and water, too much friction being avoided, but plenty of water being used.

All the soap being washed away, the abdomen should be sponged with 1 in 500 biniodide of mercury and spirit, friction being avoided, and then a compress of lint, soaked in 1 in 60 or 1 in 80 carbolic lotion,

applied and covered with gutta-percha tissue and a bandage.

Some surgeons do not use the compress, and all these directions are subservient to the wishes of the operator.

A purge, selecting for preference the usual purgative of the patient, should be given two nights before the operation, and repeated the night before, but if the patient's bowels are moved readily, the aperient should only be given the night before the operation.

A light supper is given the patient in the evening, and nothing in the morning except a little water, if desired. Should the operation be in the afternoon, an ordinary light breakfast should be given at six o'clock, and a basin of beef-tea at eleven o'clock in the morning.

In the early morning—about five o'clock—a soap and water enema is administered, and just before the operation the bladder must be emptied, but a catheter is only to be used if absolutely necessary.

The patient should be clad in flannel, with no constriction round the neck, and the legs covered with long woollen stockings.

Children may have the arms and legs wrapped in cotton-wool, with a gamgee jacket on the chest and back, especially if much shock be expected, in which case the child should lie on a hot-water pillow, or if the patient be an adult hot-water bottles should be put on the operating-table.

The bed is prepared before the patient is anæsthetized. In a simple case the patient sits up wrapped in a blanket, and the bed is then made, with the clothes turned well to the side.

A blanket is put at the fire to warm, and all the

necessary preparations are made for giving a brandy and coffee enema or a saline rectal injection (see Appendix), so that if much shock be present after the operation no unnecessary waste of time will occur in administering remedies and getting the patient warm.

All false teeth must be removed.

The anæsthetic is most conveniently given in the operating-room, but with a nervous patient it is better to get her under in her bedroom, and then to carry her into the operating-room. In a private house this is seldom convenient, and with a little care and tact she need see little of the preparations.

The patient should lie with the feet facing the window, and in most cases the surgeon will stand on the right-hand side, and his table should be placed there.

During the induction of anæsthesia no preparation whatever must be done, as touching the patient will often induce struggling. Should the patient struggle, she can most easily be controlled by holding the arms above the elbow, and the legs above the knees.

When the patient is anæsthetized the abdomen is exposed, and the two mackintoshes arranged, one above and the other below the seat of operation ; the bandage and the compress should be removed. The surgeon will usually arrange the towels and do the rest of the preparation himself. During the operation the nurse may be anything from chief assistant to a drawer of water, and she must be prepared to fill all or one of these duties at a moment's notice, and the hands must, as far as possible, be kept sterilized (see p. 11).

As a rule, the nurse's chief duty will be looking after the sponges.

Before the operation a definite number of sponges

must be put out and the number written down, and, if possible, this number should not be added to. Five is a convenient number, more than that rarely being required.

The sponges should be kept in lotion sufficiently hot so that the hand can just bear it. When the surgeon asks for a sponge it must be wrung out quite dry and handed to him, and on getting it back it must be thoroughly cleaned in the second basin, and then put back in the first ready for use. The lotion in the basins must be kept repeatedly changed. Should a sponge fall on the floor or on a blanket, it is to be put in a convenient place and not used again, and, if not absolutely necessary, another sponge should not be put out to replace it, so that the number of sponges at the beginning and end of the operation may be the same.

At any moment during the operation the nurse must be able to locate all the sponges at once, and she should be careful to note if any are cut. At the end of the operation she must see that she has them all. Serious accidents have arisen from a sponge being left in the abdominal cavity, and although the surgeon assumes all the responsibility, it is the nurse's duty to see that the number of sponges tallies.

All dressings nowadays are sterilized, and the nurse has only to hand the surgeon the dressing-box, which should be opened just at the end of the operation, after the sponges have been counted.

The nurse should be provided with a binder, and an excellent one is the 'many-tailed,' each tail overlapping the next. This should be put on with the lowest tail below the crest of the ilium, and then the tails folded over as high as necessary, the upper pair

being secured by a safety-pin. It is more comfortable than the simple binder secured with pins.

The bed.—Before the operation the bed for the patient should have been got ready. The bedstead should be a single one, so that the patient can be easily got at from both sides, and it should have a horsehair mattress.

A draw-mackintosh and a draw-sheet should be placed in position and the bedclothes folded over to one side, so that the patient can be quickly put in bed. If there is much shock, it is well to wrap the patient in a hot blanket.

Recovery from the Anæsthetic.—After the patient is put into bed she will usually vomit, and there may be difficulty with the respiration, the patient breathing deeply and becoming somewhat blue. During vomiting the head must be kept low and well turned towards one side, so that the vomit runs out of the corner of the mouth. A towel should be placed on that side to save the bed; at the same time the nurse's thumb is placed behind the angle of the jaw-bone and the jaw pushed well forwards, so that the patient's lower teeth project beyond the upper. This will carry the tongue forward, and relieve obstruction to the breathing. As the vomit runs out from the mouth it cannot be sucked back into the larynx during the next inspiration. If, with the jaw well forward, the patient still remains cyanosed and breathes badly, the mouth has to be opened. If no help is at hand the nurse must do this with a piece of wood or a spatula, care being taken not to break the teeth. Having opened the mouth, the finger is rapidly passed to the back of the throat to feel that no foreign

body—*i.e.*, sponge or something vomited—is present. The tongue must then be pulled forward, and it will usually be found that the patient quickly recovers.

Should the cyanosis continue, help is urgently needed, and before it comes the nurse may have to start artificial respiration (see p. 99).

If ordered, a coffee and brandy enema or a hot saline injection should now be given to counteract shock.

After the patient has ceased vomiting and has come round from the anæsthetic, she will begin to have various complaints, to which the nurse must carefully attend.

1. **General Discomfort and Restlessness.**— This discomfort the patient will usually attribute to the fixed dorsal position, whereas it is a natural result of the operation and the vomiting. The dorsal position is adopted—

(1) So that the abdomen is level, the wound is not pressed upon, and so ventral hernia is prevented;

(2) For convenience in feeding and nursing;

(3) If a drainage-tube is used (especially Keith's), it is not liable to be displaced or broken.

For these reasons the dorsal position is best, and, as a rule, the patient should not be allowed to turn on her side, especially as, if allowed to do so once, and being still uncomfortable in the new position, she will want to turn again, and so the restlessness will be increased. Restlessness brings with it the danger of starting hæmorrhage, and it may also cause a return of the vomiting.

The patient, then, should be kept in the dorsal position, and restlessness restrained by the tact of the nurse. But, like most rules, this is not absolute,

and if the surgeon has no objection, the patient can occasionally be turned from side to side; but this turning should be done by the nurse, and the patient should then be propped over with pillows. If bronchitis or broncho-pneumonia supervene, frequent turning from side to side may be necessary, or the patient may even have to be propped up in bed with pillows.

The way to lessen the discomfort is to have a perfect bed. The draw-sheet must be tight, with no wrinkles, the bed must not be too warm or too cold, and the pillow must be changed from time to time. The patient will specially complain of pain in the back, which is muscular in origin, due to the want of support in the middle of the back. This support can be given by a small pillow, or, better, a roll made of a soft blanket or gamgee tissue placed under the hollow of the spine. Beside keeping in the dorsal position, a pillow should be placed under the patient's knees, so as to support them in the slightly flexed position. This will relieve the strain on the abdominal wall, but the legs may be straightened by the nurse if the patient desires it. This small change of position will often prove comforting.

A bed-cradle to remove the weight of the clothes is advisable in some cases, but can usually be dispensed with if the abdomen has been completely closed and not drained. Early in the morning after the operation, or even the same evening if all goes well, the patient will be made more comfortable by having the bed re-made, and the arms and legs may be sponged over with warm water. After the operation the bed has extra blankets, hot-water pillows, etc., and a new bed with these removed is grateful and comforting. If, however, the patient is still suffering from shock, interference is to be deprecated.

2. **Thirst.**—This will be due to several reasons :

(1) Abstinence before operation.
(2) Interference with the peritoneal cavity.
(3) Loss of blood.
(4) Anæsthesia and vomiting.

This thirst is, however, partly beneficial, for the patient's tissues requiring fluid absorb the inflammatory exudation which must be present in the abdominal cavity, and so a dangerous factor is removed.

Treatment of Thirst.—After the early anæsthetic vomiting is over, if the patient complains of thirst, about four hours after the operation, she may be given 2 drams of hot water. The water should be very hot, and should be given slowly to the patient in a spoon or minim-glass, telling her to let it trickle down the throat. This may be repeated every hour, and if the vomiting does not return, may be slowly increased in quantity.

The tongue may be kept moist by allowing the patient to rinse the mouth with a little soda-water, or even a little weak tea may be taken into the mouth and then spat out again. Ice is generally to be condemned, except under special circumstances. It increases the flatulency, and leaves the patient more thirsty than before.

If the thirst is very severe, a rectal injection of hot saline fluid, 1 pint, will often relieve it. Twelve hours after the operation, if all goes well, the patient may have a cup of weak tea, or, if she prefers it, black coffee, the latter being perhaps the better, as it is more stimulating, and will sometimes relieve the feeling of nausea.

3. **Flatulency.**—This is due to the distension of the intestine with gas, and is often very distressing. If present, the rectal tube may be passed, but, as a rule, the relief from this is not great. In very severe cases the surgeon may wash out the stomach, but the real relief comes when the bowels are moved.

The aperient, and the time of giving it, is, of course, ordered by the surgeon, but perhaps the best method is to give 2 grains of calomel every two hours, starting sixteen hours after the operation, whether the patient is vomiting or not. Five doses are given, unless the bowels act, and it is then followed by 1-dram doses of mag. sulph. and sod. sulph., four hourly.

Flatulency, as a rule, will be relieved directly the bowels are opened.

Another excellent method of relieving flatulency is to give a turpentine enema about twelve hours after the operation.

The drug generally used to relieve flatulency is strychnine, and is given by injection ($\frac{1}{60}$ grain).

Hiccough.—This is an occasional and distressing complication. It is due to a spasm of the diaphragm, and may sometimes be relieved by giving a sip of water.

If persistent, a mustard-leaf can be placed on the upper part of the abdomen, or a drop of oil of peppermint or cajeput oil given on a piece of sugar.

Urine.—The patient will usually pass her urine naturally some hours after the operation, and there should be no hurry to resort to the catheter, the lapse of sixteen to twenty hours being soon enough to demand its use.

A catheter habit is easily established, which, besides being a nuisance, and necessitating extra work, always brings with it the risk of cystitis (inflammation of the bladder), no matter how careful the nurse may be. For method of passing catheter, if necessary, see p. 228.

Feeding.—In the case that has been so far dealt with there is no need to hurry the feeding, the patient having been well nourished before the operation, and usually having little desire for food soon afterwards. If there is no vomiting and the patient is taking the hot water well, twelve to sixteen hours after the operation feeding should be commenced by giving the patient milk 1 ounce, and lime-water 1 ounce. This quantity should be repeated in an hour, and then each hour, provided there is no vomiting, the quantity should be increased, at the same time increasing the relative proportion of milk to water, till the patient is taking milk 5 ounces and lime-water 1 ounce every two hours—*i.e.*, 3 pints of milk and 1 of lime-water in the twenty-four hours. This quantity should be reached about thirty-six hours after the operation.

Then semi-solids—such as custard, jelly, and bread and milk without crusts—can be added till, on the third day, the patient takes a little boiled fish and a well-cooked potato. All things likely to cause flatulency should be carefully avoided. Ordinary diet of meat is not required till the tenth day, for it must be borne in mind that the patient is lying in bed and taking no exercise. Overfeeding is to be deprecated in these cases.

Complications.—During the first few days after the operation the patient must be carefully watched, and the following complications looked for :

1. Shock. (For signs, symptoms, and treatment, see p. 93.)

2. Internal hæmorrhage. (For signs, symptoms, and treatment, see p. 78.)

3. Giving way of the abdominal sutures.

4. Peritonitis.

The abdominal sutures occasionally give way after abdominal sections, and the intestines escape through the wound.

This is often the result of straining on the part of the patient, especially if there is much cough. If the patient is suffering from bronchitis, and severe paroxysmal cough occurs, it is as well for the nurse to support the abdomen with her hands during the paroxysm, one being placed on either side of the median line.

If the sutures give way the patient will usually inform the nurse that 'something has broken,' and on examination it will be found that the binder is pushed up by a swelling underneath, or the intestine may be seen escaping under its upper or lower edge. If bulging of the binder only is noticed, nothing should be done, but the surgeon must be sent for at once, and in the interval all preparations should be made for an immediate operation under anæsthesia.

If the intestines are actually seen, they must be covered with sterilized gauze or sterilized towels, but they should not be touched, nor the binder loosened. The patient will probably be in a state of shock, and suitable treatment must be carried out.

Peritonitis.—Inflammation of the peritoneum is always due to infection of the peritoneal cavity by micro-organisms, either from the surgeon's hands or

instruments, or from injury to the intestines, in which micro-organisms are always to be found. Usually it will not become manifest till the second or third day, although in acute cases the symptoms are seen in twenty-four hours. These symptoms will be :

1. Rise of temperature and general discomfort.
2. Increasing rapidity of the pulse, which is small.
3. Abdominal pain, tenderness, and distension.
4. Respiration shallow, and the patient speaks in a whisper.
5. Knees drawn up, and the arms held above the head.
6. Vomiting, small quantities of dark material gushing from the mouth, without nausea.
7. The bowels do not react to purgatives or enemata.

Any or all of these symptoms should be watched for and reported to the surgeon, who will indicate the appropriate treatment. This sometimes is the re-opening and draining of the abdomen.

Peritonitis is usually a fatal complication.

Abdominal Operation in Children.—If the patient be a child the routine treatment before and after the operation will be somewhat different.

The aperient need only be given the night before the operation, followed by an enema in the morning, as it is usually exceedingly easy to empty a child's bowel.

In the preparation of the abdomen the ease with which a child's skin may be excoriated must be borne in mind, and vigorous friction and strong antiseptics must not be used. A child's skin also cleans much more readily than an adult's.

Rest in the proper position is assured in children by fastening their shoulders down by means of a shoulder-strap attached to the sides of the bed. A fracture-

cloth is passed across the abdomen and secured on each side of the child by means of sand-bags. Each leg is fastened down by means of a piece of bandage secured by a clove-hitch just above the ankle, the ends being attached to the foot of the bed. Pieces of lint are wrapped round the limb to prevent cutting by the bandage.

The blanket is secured across the child just below the shoulders by pins, so that the arms are outside; but if the child is very restless, and tries to get the hands under the bandage, they must be secured in the same way as the legs.

When the child has become accustomed to the restraint, the legs may be untied, but the shoulder-strap must be kept on till the surgeon gives orders for its removal.

Thirst.—After the operation, drams of hot water may be given as often as asked for within reasonable limits, to relieve thirst.

Feeding should start about four hours after the operation with milk 1 ounce, lime-water 1 ounce. This quantity should be increased each hour till by evening the child is taking milk 2 ounces, lime-water 1 ounce, every two hours.

If the child is old enough, light food—*i.e.*, custard, jelly, or blanc-mange—should be given on the third day, and an ordinary diet suitable for the age on the seventh day.

Aperients.—If the operation be done in the morning, the following morning an enema is given, and then an ordinary children's aperient—*e.g.*, syrup of senna—is given as often as necessary.

CHAPTER X

EMERGENCY ABDOMINAL OPERATIONS

Preparation — After - treatment — Shock — Thirst — Feeding — Aperients — Children's operations — Gastrostomy — Colotomy —Washing out the stomach.

In the last chapter the case considered was one that caused no special anxiety, and was done under the best possible circumstances for the patient, everything both before and after the operation being straightforward.

In the case to be now considered the conditions are entirely different. The operation is done as an emergency, there being no time for the proper preparation of the room or of the patient. The patient, far from being as well as possible, is often exhausted by an illness, or profoundly shocked by a sudden severe lesion in the abdomen. There has frequently been copious and exhausting vomiting, and the case is often of a septic nature, the patient being poisoned by the absorption of toxins.

The operation must be finished as soon as possible, and there is always grave anxiety as to whether the patient will live or not.

Preparation.—If the operation is going to take place at once, no preparation of the patient should be

done. The exposure to wash and clean the abdomen and the giving of the enema will increase the shock from which the patient is already suffering, and it is better to do all the needful cleaning and shaving of the abdomen when the patient is under the anæsthetic.

If the case is not quite so urgent, the usual preparations should be made; but if the diagnosis be that of abscess, great care must be taken in washing the abdomen that the abscess is not burst by too rigorous manipulation. The preparation should be done as quickly as possible, and all unnecessary exposure of the patient avoided.

Operation.—There are no special directions to be given to the nurse in these operations, but it is to be remembered that the patient's life often depends upon the quickness of the operation, and the nurse should see that the surgeon does not have to wait for anything. Hot-water bottles should be on the table with the patient, or if a child, it is better to put it on a hot-water pillow.

After the Operation.—All preparations for combating shock should be made before the operation is commenced. The patient is quickly placed into bed and covered with a hot blanket. Hot-water bottles are placed alongside, and a coffee and brandy enema, or a hot saline and brandy injection is given.

If continuous infusion has been ordered, it should be started at once (see p. 96).

If shock is severe, the foot of the bed should be raised on blocks, so that the head of the patient is the lowest part, and the brain is well supplied with blood.

The treatment of the initial vomiting and of asphyxia is as before described (see p. 131).

The patient is in an exhausted, starved condition, with the tissues depleted of water by the constant vomiting, and it is therefore important to give food and fluid as soon and as often as possible, especially fluid. Fluid can be given in the form of an infusion, intravenous or continuous, by injections of saline fluid into the cellular tissue, or of rectal enemata of hot water, not more than ½ pint; but it is the special duty of the nurse to see that the patient gets as much as possible by the mouth—that is, naturally.

Thirst.—The same start should be made with 2-dram doses of hot water, but it should be made as soon as the patient is round from the anæsthetic, and the water should be given more frequently, and given even if the patient vomits.

Hot lemonade will sometimes be retained when water is vomited, and it will also help to keep the mouth clean. If the vomiting ceases, a change should be made to milk and lime-water, and this the patient should be encouraged to take, not waiting till she asks for it, as in an uncomplicated case.

Thirst will also be alleviated by keeping the mouth thoroughly clean. The teeth should be cleaned by a piece of lint or cotton-wool twisted on forceps, and the mouth should be frequently rinsed with some form of mouth-wash, such as warm hydrogen peroxide, glycerine and borax, soda-water, or Cunningham's mouth-wash (see Appendix). These are all useful, but if the patient has a temperature one of the following is perhaps better: Potassium bicarbonate 10 grains, water 1 ounce, and glycerine 1 ounce, or lemon-juice and glycerine equal parts, or carbolic acid 1 in 80.

The mouth-wash not only keeps the mouth moist

and clean, but prevents the growth of micro-organisms in it. These can spread up the salivary ducts which open into the mouth and cause inflammation of the salivary glands. Neglect of cleanliness of the mouth may thus lead to abscesses forming in the parotid gland, and this complication may be the direct cause of the patient's death.

Feeding.—If the vomiting is profuse, nutrient enemata must be given. The large enemata, 10 ounces, or even 12 ounces (see Appendix), are given with a tube and funnel every six or eight hours, according as the patient retains them.

Once in twenty-four hours the rectum is washed out with plain hot water, so that a clean mucous surface is left. The next nutrient must not be given immediately after the rectal wash; at least an hour should elapse before it is given.

Should the vomiting be less severe, the patient is fed by the mouth, milk and lime-water being given as before, but the quantity and the times of feeding must be quickly increased, and that in spite of some vomiting, as it is of the utmost importance that the patient should have food. Pancreatized milk will sometimes be retained when ordinary milk is rejected. Although these patients want feeding quickly and more abundantly than an uncomplicated case, they must be kept longer on a fluid diet, for they will not be able to digest solids till the stomach has returned to its normal condition.

Special forms of food are often exceedingly valuable in these cases, and if the vomiting ceases early the milk can be supplemented with teaspoonfuls of Valentine's meat-juice, Bovril or Mason's meat-jelly.

Vomiting.—Ice in small quantities will sometimes check severe vomiting, but it should not be persevered with, for if successful it will act at once. Iced champagne will sometimes succeed where simple ice has failed, and it is also an excellent stimulant, and of use to overcome the shock, and helps to tide the patient over the most dangerous stage of his illness

Various drugs are given, such as dilute hydrocyanic acid ♏iii, oxalate of cerium gr. ii, or cocaine 10 drops of a 10 per cent. solution, and in cases where the vomiting is severe the surgeon may decide to wash out the stomach.

Aperients.—It is desirable in these cases to get the bowels open as soon as possible. The patient before the operation has had the fæces stagnating in the intestine, and the micro-organisms constantly present there have multiplied enormously, and the patient is being poisoned by absorbing their toxins through his intestinal walls. The sooner this septic material in the intestine is got rid of the sooner will the poisoning cease and the patient improve. Calomel in 2-grain doses every two hours should be given as soon as the feeding is started, and it will often be an aid to check vomiting. It is repeated for five doses, and then mag. sulph. ʒi, sodii. sulph. ʒi is substituted every four hours until the bowels act.

Enemata are also to be used to get rid of the septic fæces, but of course both these and the aperients are subject to the direct orders of the surgeon.

Children.—After emergency operations in children and infants it is especially necessary to feed early, as infants cannot stand much starvation, and

may die of inanition, although the actual lesion may be cured.

Taking for example a case of intussusception in a child a year old, ½ ounce each of milk and lime-water should be given every twenty minutes as soon as the child is round from the anæsthetic. This should be increased as before, regardless of the vomiting. In some cases the mother may be allowed to suckle the child.

The aperient and other treatment is as before stated, but special care must be taken to guard the patient against shock both before and after the operation.

Special Abdominal Operations—Gastrostomy, Colotomy.

Gastrostomy.—*Definition:* The making of a permanent artificial opening into the stomach. The ending 'ostomy' in surgery indicates the making of a permanent opening or mouth, whilst the ending 'otomy' indicates a temporary opening which it is desired will close. Unfortunately, the term 'colotomy' is used for a permanent opening into the colon instead of the more correct term 'colostomy.'

Gastrostomy consists of making a permanent opening into the stomach through the abdominal wall, and introducing a tube so that the patient can be fed through it. It is done in cases of obstruction of the œsophagus when the obstruction cannot be removed, such as carcinoma of the walls or a tumour pressing on the tube. When the œsophagus is closed nothing but death from starvation faces the patient, and to prevent this and to prolong the patient's life the operation of gastrostomy is performed. It should be

done before the œsophagus is completely closed, and for a few days before the operation the patient should be kept in bed and most carefully fed on fluid diet, so as to prepare him for the shock. If the fluid taken is not sufficient, nutrient enemata must be given.

The preparation of the abdomen, etc., is as before described (see p. 127), but beside the usual preparation to diminish shock, 6 or 8 ounces of warm beef-tea, with 1 ounce of brandy, should be ready in the operating-room, in case the surgeon desires to feed the patient on the table.

The operation consists of making an opening into the stomach through the abdominal wall, and through this opening a tube is passed. This tube comes out through the dressing, and is the means by which food is passed into the stomach.

After the operation the usual treatment for shock is carried out, and in four hours' time the feeding is commenced. A funnel is connected with the tube, and milk is given by pouring it down the funnel. A feed should be given every four hours. The first feed should consist of 4 ounces of milk, and this should be increased 2 ounces each feed until the patient is taking 10 to 15 ounces of milk and two eggs every four hours.

This quantity should be continued until the patient is allowed up, and it is important that he should be weighed regularly, so that loss or gain in weight may be noticed. In spite of the patient suffering from an incurable complaint, he will at first steadily increase in weight.

After the operation the mouth must be kept quite clean and moist, the patient suffering severely from thirst and dryness of the mouth. Any of the lotions

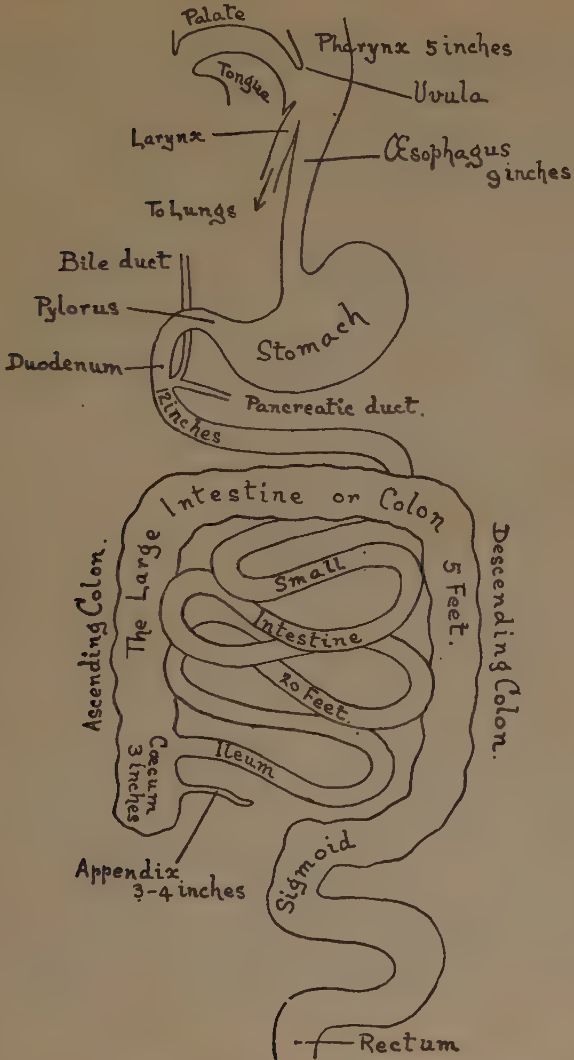


FIG. 10.—DIAGRAM OF THE ALIMENTARY CANAL

mentioned on p. 142 may be used. Thirst may also be relieved by rectal injections.

In feeding, it is most important to see that the wound is not interfered with. If it be uncovered, the most rigid antisepsis must be practised. Should the stomach contents escape slightly round the tube, the acid of the gastric juice should be neutralized by powdered potassium bicarbonate sprinkled round the wound. This will prevent excoriation and eczema. Another excellent plan is to put a thick coating of hazeline ointment under the dressing round the tube, the ointment being that made specially firm with paraffin wax.

On the third day the wound should be dressed, in case regurgitation has taken place. The tube should be removed, cleaned, and replaced.

The stitches are removed about the eighth day, and the tube is again removed and cleaned. About the end of the second week the tube is removed altogether, and only introduced for giving the feeds every four hours. The opening into the stomach is covered by a gauze dressing, with hazeline ointment underneath. The tube must be kept scrupulously clean.

After the wound is soundly healed, the patient can often feed himself by the tube, and anything which will pass down may be given.

At the same time it will often be found that the patient can swallow much better than before the operation, and he should be allowed to take by the mouth as much as he is able, but the frequent feeding by the tube must not be interrupted. Some patients will like to take solid food into the mouth, chew it well, and then spit it down the tube, thus having the pleasure and satisfaction of eating. This is an

Patient feeding himself after Gastrostomy.

excellent if somewhat nasty-sounding method of feeding.

The criterion of successful feeding is increase in weight.

Colotomy.—*Definition:* The making of a permanent artificial anus, usually on the left side, in front.

The reason for doing this operation is usually some obstruction in the rectum, such as carcinomatous stricture, simple stricture, or a tumour pressing on the lower bowel. It is sometimes done to give rest to an ulcerated rectum, or as a preliminary to a rectal operation.

The chief symptom will be intestinal obstruction, and it is to relieve this that the operation is done. It is important to note that in carcinoma of the rectum and in other rectal diseases the patient, although really obstructed, may apparently suffer from diarrhœa. This is known as 'spurious diarrhœa,' and is really the discharge taking place from an ulcerated surface, and the nurse must be careful *not* to chart the discharge as a stool on the temperature-chart, otherwise the surgeon may be misled as to the degree of obstruction. This discharge should be saved for the surgeon's inspection. The author is aware of one patient who died with chronic obstruction unrelieved owing to this discharge being charted as stools.

In preparing a patient for colotomy, if the bowels still act give an enema, but aperients should be avoided unless special orders be given, otherwise the chronic obstruction may be made acute. Of course, where the obstruction is complete it is useless to try and give enemata.

The skin of the abdomen is prepared as usual, special attention being given to the left inguinal region.

The bowel may be opened at the time of the operation or a little later, and there is nothing special to attend to till the colotomy acts. Sometimes it is necessary to give an enema by the wound to start the bowels, and this may either be a glycerine enema or a soap-and-water one.

Directly the artificial anus acts the patient must be cleaned and redressed, and although these cases are necessarily non-aseptic, yet the usual precautions for treating wounds must be taken.

The chief trouble will be the occurrence of eczema round the wound, and this must be prevented in one or other of the following ways :

1. Spreading round the colotomy opening a thick layer of hazeline ointment made stiff with paraffin wax.
2. Spreading boracic ointment round the wound.
3. Powdering the skin round with boracic powder.
4. Covering the skin round with paraffin wax at a melting-point of 100° F. This is melted and poured on the abdomen round the opening ; it sets and forms an impermeable layer over the skin. It can be renewed as often as necessary.

The most important part of the prevention of eczema, however, is frequent dressing and careful cleansing whenever the anus acts. If the fæces are liquid, as they often will be at first, Tenax, a dressing of medicated tow between layers of cotton-wool, is useful and cheap.

Later, a belt will be fitted to the patient having a plug to fit in the colotomy opening. These belts are made of indiarubber, and it is important that no

grease should be used near the wound, otherwise the rubber will quickly rot. A dusting-powder should be thickly applied under the belt.

Washing out the Stomach.—This is sometimes a preliminary to operations on the stomach, or it may be part of the routine treatment of a case of obstruction at the pylorus, with secondary dilatation of the stomach.

In the latter class of case the stomach may have to be washed out daily, and the small operation will then usually have to be performed by the nurse.

To Wash out the Stomach.—A long red rubber stomach-tube is taken, and to it is fixed a large glass funnel. Before use the tube is boiled, so that it is thoroughly clean, and to lubricate it it is dipped in hot water. It is not necessary to use glycerine or oil.

The patient should be sitting up, preferably in a chair, with the head a little forward (he will usually want to throw it back), the mouth is opened, but the tongue should not be protruded. The tube is passed in the middle line to the back of the pharynx, and the patient is told to swallow. As he swallows, the tube should be gently pushed on for about 18 inches, when it will lie in the stomach. The funnel is now filled with warm water containing bicarbonate of soda (1 dram to 1 pint), and slowly elevated above the patient's head, and as the water runs out more should be added until about a pint has passed. Before the funnel is quite empty it should be quickly lowered and inverted over a bucket, and the contents of the stomach will flow out by syphonage.

If the flow stops, it usually means that a piece of

food is blocking the tube, and it can, as a rule, be dislodged by passing a little more water down.

These manœuvres should be repeated until the water comes back quite clear, and the tube is then removed by a quick and steady pull.

After some little practice a patient can wash out his own stomach with ease.

CHAPTER XI

TRACHEOTOMY AND INTUBATION

Tracheotomy — Causes for operation — Diphtheria — Symptoms — Preparations — Taking cultures — Operation — Care of tube — Feeding — Care of wound — Complications — Intubation — Instruments — Feeding — Care of tube — Isolation and disinfection.

Definition. — Tracheotomy is an operation to open the trachea when there is obstruction to the breathing in the pharynx or larynx.

Inspired air passes in through the nose down the naso-pharynx into the larynx, then on through the trachea into the bronchi, and so into the lungs. Should some obstruction occur above the trachea, it is necessary, in order to keep the patient alive, to make an artificial opening into that tube, and this must be kept open as long as the obstruction exists.

The common causes of the obstruction are :

1. Inflammation and œdema of the larynx, due to burns, scalds, bites of insects, ulceration, and Bright's disease.

2. Tubercular and syphilitic disease of the larynx.

3. New growths (tumours) of the larynx, either innocent (papillomata) or malignant (carcinomata).

4. Pressure of growths outside—*e.g.*, goitre, malignant glands.

5. Diphtheria.

6. As a preliminary to some operation, such as excision of an epithelioma of the tonsil.

In some of these cases the tube will be left in permanently, in others it will be removed as soon as possible, and of these cases the most important is diphtheria, especially if it occurs in a child.

Diphtheria is an acute contagious specific disease. Contagious because it can be conveyed from person to person; specific because it is due to a definite micro-organism, the Klebs-Loeffler bacillus.

The bacillus attacks mucous membranes (or more rarely the skin), especially the mucous membrane of the throat and larynx, and causes an acute inflammation. This inflammation on the surface of the mucous membrane results in the formation of a false membrane, which is a white-looking substance firmly adherent to the underlying structures. It is composed of the dead cells of the mucous membrane, held together by coagulated inflammatory lymph, and contains the bacillus. It is by means of this membrane and the discharge from the mucous membrane as it separates that the contagion is carried from patient to patient. This false membrane can only be separated from the mucous surface with difficulty, and after it is removed the mucous membrane is seen covered with little bleeding points. This phenomenon is one of the diagnostic features of diphtheria, but the only absolute proof of the disease is the presence of the diphtheria bacillus, as other micro-organisms can cause the formation of a false membrane.

Besides the bacillus, which is essential, bad hygiene and bad drainage predispose to the disease, and it is most likely to attack people run down in health.

The growth of the organism on a mucous membrane causes the formation of the false membrane, and also a general poisoning of the patient, or toxæmia due to the absorption of poisons (or toxins), and this poisoning shows itself in general muscular weakness, heart weakness, albumen in the urine, and later, paralysis of muscles, besides rise of temperature and general malaise.

The incubation period of the disease is from two to eight days, and the bacillus is very tenacious of life. It may cause infection after it has been on dry clothes for six months.

The disease is chiefly seen in the mucous membranes of the nose, pharynx, tonsils, and larynx, and in children, with their smaller air-passages, is particularly liable to close the opening between the vocal cords (rima glottidis), and add asphyxia to the symptoms, thus necessitating tracheotomy.

Diphtheria may occur in the larynx only, and no false membrane be seen in the throat. The symptoms by which the disease in the larynx is suspected are :

1. Slight rise of temperature and general malaise.
2. Cyanosis (blueness) and collapse.
3. Sucking in of the ribs with each inspiration.
4. Stridor, cough, hoarseness of voice.
5. Rapid pulse and respiration.

The treatment in this stage is medical, and at the present time consists of giving injections of the antidiphtheritic serum, together with local attention to the throat ; but the oncoming of the following symptoms—restlessness, retraction of the ribs, and cyanosis—indicate that tracheotomy or intubation will be necessary ; and if a nurse is attending a case of diphtheria, these symptoms, and especially any sudden

increase of them, should cause her to send for the surgeon in charge.

These cases are often emergency operations, and the nurse who takes over the charge of the patient should first take the temperature of the child, and then give a warm bath, which may relieve the dyspnœa (breathlessness) considerably, and will also clean it ready for the operation, if that be necessary.

A specimen of the urine should be obtained, if possible, so as to be tested for albumen, and, if ordered, the injection of anti-diphtheritic serum should now be given (see p. 56).

Taking a Culture.—In hospital and in many private cases nowadays the surgeon will want to take a culture from the throat, and to do this the following things are necessary:—

Spirit-lamp, matches, culture-tube, a piece of platinum wire on a glass handle, a tongue depressor, and a receiver.

To take a culture, the platinum wire is sterilized by putting it in the flame of the spirit-lamp, and when it is cool the mouth is opened, the tongue depressed by the spatula, and the wire is rapidly rubbed against a piece of false membrane on the throat.

The cotton-wool in the culture-tube is then removed, the wire rubbed against the gelatine in the bottom of the tube, the cotton-wool stopper is set alight, thrust into the test-tube, and the flame blown out. Sixteen to thirty-six hours' incubation will demonstrate the growth of the diphtheria bacillus.

Instruments for Tracheotomy.—If tracheotomy is decided upon, the following must be got ready:

1. A table, which should be higher than that gener-

ally used for operating. In a private house a chest of drawers is often found suitable.

2. A small sand-bag, or some substitute, such as a bottle wrapped in flannel, to support the neck.

3. Blanket and mackintosh to cover the table, and a small blanket to wrap the child in.

4. Apparatus for chloroform anæsthesia (see p. 125).

5. Tracheotomy instruments and tubes in an instrument dish.

6. Piece of tape long enough to go twice round the

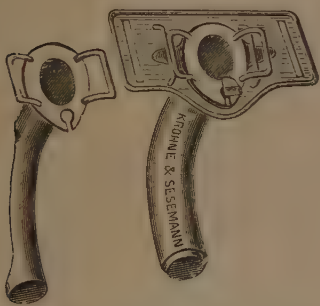


Fig. 11. — Tracheotomy Tube and Inner Tube.

Fig. 12. — Cresswell's Tracheotomy Tube. (No pilot is required.)

neck of the child to tie the tube in with. The ends of the tape should be cut sloping, so as to readily pass through the holes in the tracheotomy tube.

7. Feathers, which must be carefully looked at, to see they are not broken.

The nurse will often have to sponge and otherwise help the operator.

After-Treatment. — After the operation the child is put back to bed and the usual methods

taken to counteract shock, and it will usually happen that the relief of the operation is so great that the child will fall asleep, and remain quiet for some time.

The nurse should study carefully the tracheotomy tube used. There are many different kinds, but all consist of an outer tube fitting into the trachea and an inner tube which fits inside the outer. With each tube is a director or pilot, by means of which it is placed in the trachea. The outer tube is secured by tapes passed round the neck, and only under circumstances of grave necessity must it be removed, except by the surgeon's orders, whilst the inner tube has to be constantly removed for cleansing purposes. During the nursing of a tracheotomy case the following instruments should always be close at hand :

(1) Dissecting forceps ; (2) probe ; (3) scissors ; (4) receiver ; (5) bowl of lotion to wash the inner tube ; (6) tracheal dilators ; (7) spatula ; (8) pilot.

Each instrument should be sterilized after use, and put back on the stand.

Care of the Tube.—The nurse must always be at hand to swab the mouth of the tube, and especially to catch any pieces of membrane that may be expelled during a fit of coughing. This membrane should be saved for inspection. Directly the inner tube gets blocked it must be removed and cleaned with a little alkaline lotion and then replaced. It should never be left in position more than two hours at a time, otherwise it may stick to the outer tube and be difficult to remove. In cases of 'dry' diphtheria, where the membrane is not easily coughed up, the inner tube should be taken out and warm alkaline lotion—bicarbonate of potash 10 grains to water 1 ounce

—sprayed into the outer. This will help loosen the membrane, and so it will be removed.

If, in spite of the inner tube being clear, the breathlessness returns, it means that the membrane is blocking the trachea beyond the tube, and a damp feather should be pushed through the outer tube into the trachea. This will excite violent coughing, and the membrane may be expelled. If, in spite of this, the membrane is not removed, the surgeon must be sent for; but if in the interval of his coming the dyspnœa becomes urgent, the outer tube must be removed, and the trachea held open with the dilators. But, as before stated, this should only be done under grave circumstances.

The mouth of the tube should be covered with a piece of gauze to clean the air as it passes in, and so help to prevent broncho-pneumonia.

Feeding.—The child should be fed every two hours, 4 ounces of milk with barley-water being given at each feed to a child two years old. The child should be encouraged to take food freely, but it must not be forced to complete the whole feed, otherwise vomiting will occur.

In severe cases the food will regurgitate through the nose, or it may pass into the trachea and be expelled through the wound or tube. Under these circumstances it will often be found that if the milk be thickened with arrowroot it can be swallowed quite readily. If, however, the food still regurgitates and causes coughing, or if there is a distaste and resistance to food, the nasal tube must be used (for method see p. 174).

In a favourable case semi-solids can be swallowed

on the third day, and the dietary should gradually return to that suitable for the age of the child. During convalescence the child should be generously fed.

Care of the Wound.—The wound usually heals well under a small dressing of boric lint fitted under the flange of the tube. Cyanide gauze is also suitable, and both should be changed as they become saturated with discharge. Later boric acid fomentations may be useful.

Care of the Throat and Nose.—If there be membrane in the throat or nose, the nurse may receive orders to syringe them with some lotion. This can be done by any of the methods mentioned under throat operations, but in children the following plan is usually most successful.

The child is wrapped in a blanket to secure the legs and arms, placed on one side, with the head well over. A Higginson's syringe, specially kept for the purpose, is used. The nozzle is placed on one side between the child's teeth, and on syringing the fluid will run out of the opposite side of the mouth. If nasal discharge is present, it should be treated in the same way, the syringe being placed in one nostril. Chlorine water makes an excellent lotion for this purpose.

Removing the Outer Tube.—This will be removed as soon as possible—*i.e.*, on the second or third day—otherwise the child will get accustomed to it, and removal will be difficult.

The dilators must always be near at hand, and during the removal of the tube the child's attention should be attracted elsewhere from the manipulation by a new toy, etc.

It is possible in some cases to remove it during sleep.

Directly it is removed it must be cleaned and fitted on its pilot, and kept ready for instant replacement along with the dilators, as urgent dyspnœa may come on at any time, and there is then no time to search for things.

If it become necessary by a return of the dyspnœa to replace the tube, the child, quickly wrapped in a blanket, should be placed on the nurse's lap, with the head hanging back slightly. The dilators are then inserted in the trachea gently and steadily, and the child will immediately cough. The dilators are then transferred to the left hand, and holding the trachea open, the tube is replaced with the help of the pilot. The dilators and pilot are then removed, and the tube secured by a tape. If the delay has been considerable, artificial respiration should be immediately started and persisted in.

Complications.

Heart Failure.—The child must be kept lying down and as quiet as possible, but it is better to let the child move about than struggle with it to keep it still.

Stimulants will often be ordered.

Broncho-pneumonia.—The temperature of the room must be kept at 67° F., and it is important to see that whilst the tube is not covered with the clothing, the chest and arms of the patient are exposed as little as possible.

Persistent Vomiting.—Give small feeds, and if vomiting persists, pancreatize the milk ; as a last resource, rectal feeding.

Suppression of Urine.—The urine, if possible, should always be saved and measured, so as to give warning of the onset of this complication.

Paralysis.—This is usually a late complication, and will show itself in regurgitation of the food back through the nose, in alteration in the voice, the child speaking through the nose, or in squinting.

It requires absolute rest, otherwise heart failure may end the scene.

Antitoxin Rashes.—These are the effect of the antitoxin injection, and, as a rule, appear nine or ten days after the injection, and may be of several varieties of rash. The most common is an urticaria in red patches. They are of little consequence, and the itching often accompanying them can be relieved by sponging with 1 in 40 carbolic lotion or liquor carbonis detergens.

Intubation of the Larynx.—Another method of relieving the dyspnœa in diphtheria and other diseases obstructing the air passages is by intubation of the larynx. In this operation, which is done without anæsthesia, a tube is passed from the mouth into the larynx by means of a special holder. The tube lies in the opening between the vocal cords, and forms an artificial wind-pipe, through which the patient breathes. To this tube is attached a silk thread, which may be removed before the surgeon leaves, but in many cases is brought out of the patient's mouth, and attached to the cheek by means of a piece of strapping. The latter method is much preferable from the nurse's point of view. The instruments and the tube used are sold in sets, and go by the name of O'Dwyer's intubation instruments.

FIG. 13.—O'DWYER'S INTUBATION APPARATUS.

Gag; forceps for removal; scale; various sized tubes; introducer.

If it be decided to intubate a case of diphtheria, the only special preparation necessary is the sterilization of the instruments by boiling. The arms of the little patient should be encased in a piece of thin cardboard rolled into a tube, and lined with cotton-wool. This splint should extend from the axilla to just above the wrist, and should be worn until the tube is removed. It allows the child to play with toys and books, but prevents him from reaching his mouth and interfering with the tube.

During the operation the child should be lying in bed wrapped in a blanket, with the arms at the side, and the neck slightly extended over a small sand-bag placed under the neck. The nurse's duty will usually be to hold the head steady. A little vaseline should be got ready to lubricate the tube with just before it is introduced.

After-treatment.—Immediately the tube is in, the patient should be turned on his side to facilitate the escape of mucus, which is usually violently coughed up. After a severe bout of coughing, the breathing will become easy, and the child will usually sleep. The nurse will now probably be left in sole charge of the patient.

Feeding.—Feeding by the mouth can be carried out in a large number of cases, and unless special orders are given, this should be the first method adopted.

Food suitable to the age and condition of the patient should be given. As the patient is suffering from an acute illness, this will at first be milk.

For young children the milk should be given slowly with a spoon, but with older children the feeding-cup

may be used. If swallowing fluid excites more than a little cough, the milk may be thickened with arrowroot.

If, in spite of thickening the food, the cough persists on feeding by the mouth, this method must be given up, and the nasal tube used, as after tracheotomy. In a few cases rectal feeding will be necessary.

A point to be noted is that in some cases food will be taken well while the tube is in, but after its removal nasal feeding may have to be resorted to for a day or so.

It has been stated that fluid can be more easily swallowed in these cases if the foot of the bed be raised so that the child drinks uphill (Casselbury's position). This position is, as a rule, quite unnecessary, but it may be tried in difficult cases.

Care of the Tube.—Beyond seeing that the patient does not interfere with the tube, and that it is not shifted during feeding and other manipulation, the nurse has little to do in an uncomplicated case. There is one condition in which it is necessary for the nurse to be prepared to interfere promptly, and that is when the tube is blocked with a piece of membrane. This condition will be shown by a sudden attack of dyspnœa, the patient rapidly becoming cyanosed and ceasing to breathe. The nurse should at once send for the surgeon, but in the meantime, if the patient's condition is desperate, the tube should be removed and artificial respiration started. The removal of the tube is easy if the silk string has been left attached, the only manipulation necessary being a steady pull.

If the string has been removed, the tube must be 'expressed.' The child should be lying on its side

near the edge of the bed, and the thumb is placed in front of the trachea just below the level of the lower end of the tube. The thumb is carried upwards and backwards with steady pressure, forcing the tube out in front of it. As soon as it is in the mouth it is removed with the forefinger of the other hand.

In some cases during a paroxysm of coughing the tube may be ejected. If this should occur the nurse must at once send for the surgeon, and whilst awaiting his arrival the tube should be cleaned, fitted on to the introducer, and the gag got ready for use. As a rule, urgent symptoms will not arise before ten or thirty minutes, but should the dyspnœa be urgent before the arrival of assistance, artificial respiration must be started. An injection of ½ dram of brandy might keep the patient alive for a few minutes longer. If the surgeon does not arrive quickly death may occur.

The other complications and their treatment are the same as those that occur in tracheotomy, and this operation may have to be done at any time if intubation fails to relieve.

Isolation and Disinfection.—Diphtheria being an infectious disease, care must be taken to prevent the spread of the contagion. The child must be isolated, and only such people as are absolutely necessary should be allowed to see it. Above all things, kissing must be prevented. After all attentions to the patient the nurse should wash, and then dip her hands in 1 in 60 carbolic. All swabs, pieces of linen, etc., that come in contact with the discharge must be burnt, and books, toys, etc., should be destroyed.

Linen should be put into perchloride of mercury, 1 in 1,000, and left to soak for twenty-four hours.

It is then absolutely safe to send to the laundry. Carbolic 1 in 20, or lysol, can be substituted for perchloride, but they are both more expensive.

Blankets and woollen goods should be fumigated before being sent to the laundry. They can be spread about the room and left whilst it is being disinfected.

After nursing an infectious case the nurse should have a warm bath with plenty of soap, taking care to wash the hair thoroughly, and then sponge herself with 1 in 60 carbolic, which should not be added to the soapy water, otherwise its virtue is lost.

An entirely clean set of clothing should be put on, and the used one treated as above. The patient also, before mixing with other people, should have a carbolic bath and a clean set of clothes.

All dressings should be burnt.

All cups, plates, spoons, knives and forks should be disinfected with boiling water. The hair-brush and comb should be washed with 1 in 20 carbolic.

To disinfect the room the floor-space around the bed and the walls should be washed down with 1 in 1,000 perchloride of mercury, and then with soap and water. The bed should be carbolized with 1 in 20 carbolic and then washed with hot soap and water.

The room should then be sealed up by stopping up the fireplace, and pasting brown paper over all the cracks and crevices in the windows, doors, etc.

A pound of sulphur should then be placed on some hot coals on a shovel placed over a bath of water in the centre of the room, and the room kept closed for twelve hours.

It should then be opened, and when the fumes of the sulphur have gone, should be thoroughly washed, and all the furniture it contains cleaned.

CHAPTER XII

TONGUE AND MOUTH OPERATIONS

Differences from other operations—Cancer of the tongue—Preparation—Operation—After-treatment—Cleaning the mouth—Nasal feeding—Hæmorrhage—Pneumonia—Heart-failure—Painful swallowing—Cleft palate—Hare-lip—Aural nursing—Nursing in nose cases.

The most important operations on the tongue and mouth are those done for removal of malignant growths, such as cancer of the tongue or upper jaw, sarcoma of the naso-pharynx in young subjects, and cancer of the floor of the mouth. Of importance in children are operations on hare-lip and cleft palate.

These operations are generally severe, and they have the following points to be considered:

1. It is impossible to completely sterilize the site of the operation, and the mouth always contains many micro-organisms.

2. Pressure cannot be brought to bear to stop oozing from the wound.

3. Blood and septic matter may be swallowed, and subsequently vomited.

4. Blood, food, and septic matter may be inhaled into the trachea, and cause symptoms of asphyxia, and later broncho-pneumonia.

5. They usually take place in elderly subjects, often enfeebled by a painful illness and want of food.

As an example of these operations, a case of carcinoma of the tongue will be taken, and the patient in a typical case will present the following clinical picture :

The patient is an elderly man between forty and sixty, who is beginning to show the signs of the cancerous cachexia (see p. 107). On examining the mouth, the tongue is found to be the seat of a deep, hard-edged ulcer, which prevents the patient from protruding it properly. The breath is very foul, and the patient is constantly wiping away the saliva and discharge which runs out of the mouth. The voice is a little altered, owing to the swelling and fixity of the tongue, and the chief complaints are of pain running up to the ear, and inability to eat without the food collecting in the side of the mouth.

The glands in the neck are frequently enlarged on the same side as the ulcer, and in some cases the enlargement is out of all proportion to the size of the ulcer, and it may be the first thing that attracts the patient's attention.

When such a case is diagnosed as malignant disease of the tongue, the only treatment is removal of the whole or half of the organ, and extensive excision of the glands at the side of the neck.

This may be done in one operation, but many surgeons prefer to remove the tongue first, and subsequently to deal with the glands.

As the nurse is sure to be asked the effects on the patient of removal of the tongue, it is well for her to know the following facts :

1. Removal of the tongue is a serious operation, with a considerable mortality in advanced cases, but in early cases the immediate prognosis is good.

2. Complete cure may follow.

3. Recurrence is unfortunately common.

4. The patient will be able to talk well even after the removal of the whole tongue, and although the speech will be altered, there will be little difficulty in understanding what he says.

5. Eating will be only a little interfered with, the chief difficulty being the collection of food at the side of the mouth.

6. The deformity, even in extensive gland operations, will be slight.

Preparation of the Patient.—If the patient be old and feeble, and the growth extensive, he should be kept in bed for a few days before the operation and very carefully fed, so that he is in the best possible condition for withstanding the shock; but if he be in good health, except for the local disease, he can continue his usual habits until the day before operation.

The mouth must be got as clean as possible, and at least three days should be occupied in doing this. It should be rinsed out every three hours with some antiseptic mouth-wash, such as permanganate of potash, 10 minims of the solution to an ounce of water, or peroxide of hydrogen (for other washes, see Appendix), and cleaned after every meal.

The spaces between the teeth and the ulcer itself should be cleaned thoroughly with pieces of lint dipped in 1 in 1,000 perchloride of mercury, and the patient should clean his teeth three times a day with a tooth-brush and carbolic tooth-powder.

All this preparation should be repeated an hour before the operation.

During the day or two previous to the operation the patient should be shown the way in which he will have to be fed after the operation, and the method by which the mouth will be kept clean, so that he will be able to render assistance. It is, however, important not to frighten him by over-elaboration of the details, especially if he be nervous. The night before the operation the face and neck must be carefully shaved, and the usual preparation of the skin done. The extent prepared should be from the eyes to the clavicle on both sides of the body, and the ears should be thoroughly cleaned. A compress should be applied covering the neck and the side of the face. The other preparation of aperients and enemata is the same as for abdominal operations.

The Operation.—The patient's hair should be covered with an indiarubber or jaconet cap, and a mackintosh should be placed under the head. The operating-table should be, if possible, somewhat higher than for an abdominal case, and a Junker's chloroform inhaler should be placed on the anæsthetist's table.

During the operation itself the nurse's chief duty will be to supply the surgeon and the anæsthetist with plenty of small sponges or swabs on holders, so that the mouth can be kept clear of blood.

If sponges are used, they should be cleaned in the same way as the sponges for abdominal work, but if swabs, a fresh one should be placed on the holder directly the surgeon has swabbed the mouth.

The bed should be arranged in the same way as given in the chapter on abdominal operations, but a mackintosh should be placed over the head of the bed.

The usual preparations for counteracting shock are made.

After-treatment.—After the operation the patient will be in a condition of shock; he will have lost a good deal of blood, will have had chloroform anæsthesia, and probably will still have some bleeding going on in the mouth.

For these reasons the patient must be kept lying down, well on one side, so that the blood may collect into the cheek, and then run out of the mouth, and a pad of wool or gauze should be placed under the mouth to prevent soiling of the pillow and sheets. If much mucus and blood collects in the mouth it must be wiped away from time to time with swabs dipped in 1 in 1,000 perchloride of mercury, but care must be taken to avoid the actual wound, especially in Whitehead's excision of the tongue, otherwise the ligatures may be wiped off and hæmorrhage started.

The swabs must not be pushed far back into the pharynx, or swallowing movements will be induced, and also the secretion of an excessive amount of mucus will take place. The usual treatment for combating shock must be carried out (see p. 95).

As soon as the shock of the operation and the effects of the chloroform have passed off—that is, in about twelve hours—the patient should be propped up in bed with pillows or a bed-rest. This will enable the food to be taken more readily, either by mouth or by nasal feeds; it is more convenient for keeping the mouth clean, and will diminish the chance of pus and blood being inhaled into the trachea, and causing broncho-pneumonia.

Some surgeons, however, prefer to keep the patient

lying on the side, and this should always be done if the operation has been very severe and the hæmorrhage great, as there is danger in these circumstances of the patient dying from heart failure. If kept lying on the side, and half the tongue or upper jaw has been removed, the patient should lie on the sound side, and in feeding care should be taken to pass the tube on the sound side too, so that the wound is not interfered with

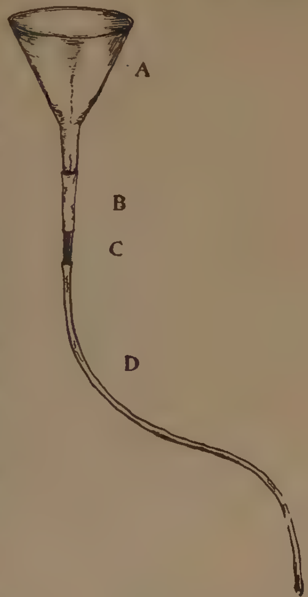


FIG. 14.—FUNNEL AND TUBE FOR NASAL FEEDING.

A, Funnel; B, indiarubber tube; C, glass tube; D, Jaques' catheter, No. 6.

Feeding.—On the second day the patient is usually able to swallow fluids, taking food from a feeder, to the spout of which is attached an indiarubber tube, milk being given, and the patient being fed every two hours, at the same time that the mouth is cleaned. In severe cases, and where the shock is great, the patient should be fed with nutrient enemata (see p. 143).

If the patient cannot readily swallow, he should be fed by means of the nasal tube, and some surgeons always prefer that food should be given in this way for the first few days, as there is less likelihood of starting hæmorrhage, and the wound is kept cleaner. The disadvantage is its unpleasantness ; patients much

prefer to be fed by the mouth, and this should always be done unless the surgeon orders otherwise.

Method of Nasal Feeding.—The apparatus consists of a small glass funnel, to which is attached an indiarubber tube. This is connected by means of a short piece of glass tubing with a No. 6 soft indiarubber catheter.

The feeds consist of warm milk and eggs, one egg to a pint of milk, and from a pint to a pint and a half should be given at each feed, and the patient fed three or four times a day. To pass the tube it should be lubricated with a little glycerine and borax, plain glycerine, olive-oil, or, perhaps best of all, with a little milk. The patient should be sitting with the head held level, and the tube should be passed directly backwards, *not upwards*, and steadily pushed on without jerks. It will then pass into the naso-pharynx, and there may catch for a moment. It should not be withdrawn, but when it is noticed that the patient is making efforts of swallowing, it should be steadily pressed on. The tube should pass into the œsophagus, and cause the patient no discomfort.

Difficulties.—1. Occasionally the tube will curl up and come out of the mouth, where it can be seen, and the patient will usually call attention to the fact. Under these circumstances it should be pulled into the nose again, and then the patient told to swallow as soon as he feels it passing from the nose.

2. The tube may pass into the larynx, where it will usually excite violent cough, even if the patient be semi-unconscious. If cough is excited during the passage of the tube, it must be immediately removed,

and on no account must fluid be poured down it while the patient is coughing.

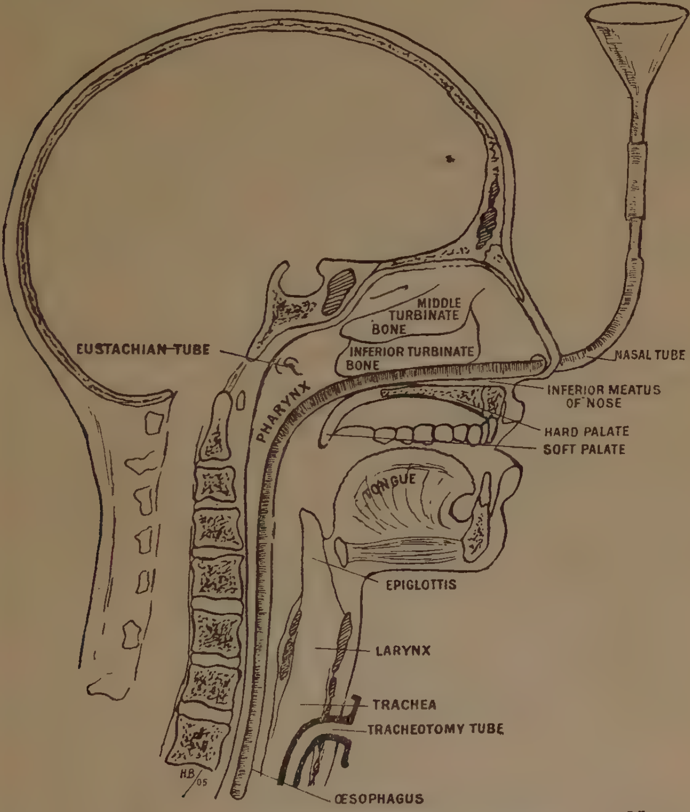


FIG. 15.—DIAGRAMMATIC SECTION THROUGH THE HEAD AND NECK, SHOWING THE NASAL TUBE AND THE TRACHEOTOMY TUBE IN POSITION.

3. In cases in which an extensive operation has been done on the neck as well as on the mouth and tongue, the tube may pass into the wound. Here it will cause

pain, and the patient will usually complain, and also the tube will not move freely or the fluid run easily, as it will when in the œsophagus.

The tube being in position and the patient comfortable, a little water should be run down the tube to make sure it is clear, as water will do less harm in the air passages than milk.

The feed should be given by pouring the milk into the funnel and slowly raising or lowering it, and should not be given too quickly, otherwise it will regurgitate through the mouth, or some may pass into the larynx, exciting cough. Should either of these occur, the flow should be stopped by pinching the tube and lowering the funnel until the cough ceases. If it continues, the tube must be removed. After the feed has been given, a little water should again be passed to clear the tube. The funnel is then raised till the tube is straight, the indiarubber pinched tightly, and withdrawn steadily. In this way the last few drops are prevented from entering the larynx. The apparatus should then at once be cleaned and put aside.

In cases where nasal feeding causes much discomfort, the tube should be passed through the mouth and down the pharynx. It should always lie, if possible, on the side away from the wound, and the nurse should be chiefly guided by the patient's sensations in passing it, allowing him to adjust it, and it should not be pushed down the patient's throat, but he should swallow it. It is only necessary for it to lie well in the œsophagus—that is, about 9 inches from the teeth. The feeds should be given as before.

It will often be found that the patient will have some increased difficulty in swallowing about the fifth or sixth day, but this will pass off, and need cause no

alarm. As soon as the patient can swallow without discomfort semi-solids should be added to the diet, and very gradually the patient resumes his ordinary habits.

Cleaning the Mouth.—The mouth should be kept clean with the lotion used for that purpose before the operation, and one of the following methods can be adopted :

1. Syringing with an indiarubber tube fitted on the nozzle of a glass syringe.
2. Swabbing with pieces of sponge or lint dipped in the lotion.
3. Spraying.
4. By means of a douche-tin suspended above the patient's head, and having attached an indiarubber tube with a glass nozzle (a female glass catheter answers admirably).
5. By means of a Higginson's syringe, the patient lying on the side, and the nozzle introduced between the teeth. This is particularly useful in children (see Diphtheria, p. 160).

It is often important not to trust to any one method, but to combine two or three of them, the methods used depending on the character of the discharge from the wound, and the ease with which it is removed. Thus, for thick, ropy mucus and for keeping the teeth clean swabbing is best; while for the removal of pus from the wound one of the other methods should be adopted. The mouth should be thoroughly cleaned every two hours, not oftener, so that the patient may get plenty of rest. The mouth should be cleaned, the feed given, and then the mouth cleaned again. The whole process will take from twenty minutes to half an hour,

and the patient will then have an hour and a half clear interval for rest and sleep. After the first day or two the patient can usually materially assist in keeping the mouth clean. During the cleaning of the mouth it is important to keep the dressings on the neck unsoiled, and they should be protected by means of a piece of jaconet. If gauze plugging has been put into the wound, it should not be touched until directions have been given by the surgeon to do so. It will usually be removed on the second or third day, and the cavity should then be thoroughly cleaned by syringing, and if ordered, iodoform or other antiseptic powder should be blown in with an insufflator.

Special Dangers.—Special dangers which follow these operations are :

1. **Suffocation** from blood or pus entering the trachea. This should be prevented by the methods mentioned to be adopted after the operation is over, and by keeping the mouth thoroughly clean. If the surgeon has reason to fear that great difficulty in breathing will be present after the operation, he will have left a silk string through the tongue, the end hanging out through the mouth. This loose end should be lightly looped over the patient's ear, and secured by a piece of Mead's strapping. In cases of difficulty the string should be pulled upon and the tongue or its stump thus drawn well forwards.

2. **Hæmorrhage,** especially after Whitehead's operation on the tongue. The preventive treatment of this has already been given, but should it occur, the mouth should be held open with a gag, two fingers laid on the stump of the tongue, and pressure made

downwards and forwards. Hæmorrhage can thus be controlled until help arrives. If it is not possible to do this, or the hæmorrhage is not from the tongue, firm pressure should be made on the bleeding spot with a piece of sponge or lint on a holder. If possible, this should be dipped into some hæmostatic (see Hæmorrhage, p. 85).

3. **Septic Broncho-pneumonia** from the inhalation of pieces of food or pus. The preventive treatment is keeping the mouth clean, and by careful nasal or other form of feeding. The onset of this complication usually occurs about the third day, and the symptoms are rising temperature, cough with difficulty of expectoration, cyanosis, increased pulse and respiration rate. This complication is usually fatal, and demands the ordinary nursing of a broncho-pneumonia case, but at the same time the surgical aspect of the mouth should not be neglected.

4. **Heart Failure.**—As has been pointed out, these operations usually take place in people past middle life, and are of a severe nature, and so the liability of heart failure has always to be borne in mind. In cases where it seems likely to occur, the patient must be nursed lying on the side, the utmost care must be taken in shifting him when the bed is changed, and although the mouth must be kept clean, it must be particularly seen that the patient has sufficient rest and sleep. Stimulants will usually be ordered by the surgeon, and if alcohol is given, it should be mixed with the feeds.

Painful Swallowing.—In certain conditions of the throat—such as cancer, scarlet fever. or diphtheria

—swallowing may be painful. This pain may be relieved in the following manner: The nurse standing behind the patient, who should be seated on a chair or bed, places the palms of each hand, with the fingers pointed directly upwards, over the ear on the corresponding side, and then makes firm pressure towards the middle line. The greater the pressure the greater will be the relief from the pain during swallowing.

Throat Operations on Children. — **Cleft Palate and Hare-lip.** — The nurse should, if possible, be in attendance a few days before the operation takes place, so as to accustom the child to her authority, and also that she may wash the roof of the mouth with a hand spray in order to accustom the child to it, so that after the operation he may not object.

These children should be fed 'little and often.' Milk and barley-water, in suitable quantities to the child's age (see p. 287), should be given every two hours, and the child should either be fed with a spoon while sitting up, or with a slipper-bottle furnished with a large soft teat, which has a hole on its under surface. If a teaspoon is used, it must be passed far back over the tongue.

The other preparations for the operation are as usual. The hair should be securely covered with a closely-fitting mackintosh cap.

After the operation, the child must be placed with its head well to one side, so that the saliva and blood may run out of the mouth, and if it be an infant, the nurse had better keep it in her arms for awhile, with the face directed downwards.

Feeding.—Directly the child expresses a desire for drink, a sip of water, hot or cold, may be given him in

a teaspoon. Milk should not be given, as it militates against cleanliness.

In the case of an infant, milk and water in suitable quantities should be given six to eight hours after the operation, and if the patient does not take it well, pancreatized milk and water should be given by the bowel. When the child can swallow—*i.e.*, in about twenty-four hours—beef-jelly may be given with a teaspoon. In the course of a day or two chicken or meat run through a fine sieve, bread and milk, or soft custard pudding may be given, according to the age of the child.

Care of the Mouth.—If the child will readily allow it—and it usually will if it has been practised before the operation—the mouth should be sprayed with a mild solution of Condy's fluid (ʒii ad Oi) every four hours, and after the taking of food, but it must not be done if the child is frightened or resents it. The nurse while doing the mouth must not look to see if the stitches are holding, as all unnecessary manipulations are to be avoided. If old enough, the child should be syringed sitting up, with its head held over the basin. If the patient be an infant, the field of operation can be gently brushed over with a camel-hair brush dipped into warm boracic lotion whilst it opens its mouth to cry.

The child must be watched continuously night and day to prevent him putting his fingers or toys into his mouth, and it is as well to fasten the arms down with stiff tubular splints, as then such constant attention is not necessary.

If more than an infant, he must be kept constantly amused, so that he does not cry, and on no account

must he be allowed to talk. If old enough, he can make his wants known on a slate, and this should be explained to him before the operation.

If the weather be fine, he can be got out into the fresh air after the first twenty-four hours.

After the operation of hare-lip the child's breathing may become embarrassed, as the nostrils are apt to be blocked up with dry mucus and blood. The nostrils should be kept clear by gently wiping, but if the dyspnœa continue, the nurse should depress the lower lip until the child has become accustomed to the altered condition.

If the sutures give way, the lip must be frequently bathed with warm boracic lotion, and kept covered with wet boracic lint.

Nursing in Aural Cases.—Syringing the Ear.—This is frequently done to remove wax from the external auditory meatus, or to keep the middle ear or tympanum clear of discharge in cases of otorrhœa, with perforation of the tympanic membrane.

After operations on the mastoid antrum, the discharge which is always present has to be removed by syringing with various lotions. The best syringe is one made of brass, and should hold about 4 ounces. Before use, the nozzle, which should be detachable, must be sterilized by boiling. The piston should often be placed in carbolic lotion, and lubricated with carbolized vaseline.

To catch the fluid after injection, a receiver, shaped to fit closely to the neck, may be used, or, better, the specially-made ear trough, and the patient should be directed to hold the trough with the hand on the opposite side to the ear which is being syringed. It will

be found that the trough is held more closely to the head in this way, and the arm of the patient is not in the operator's way.

The lotion used for syringing must always be warm —between 100° and 105° F.

The patient should be seated, and placed so that the light falls upon the ear with the receiver in position.

The syringe having been filled, is turned nozzle upwards, and all the air expelled by pressing the piston up.

With the left hand the nurse then draws the ear upwards, backwards, and outwards, so as to straighten the canal as much as possible. The nozzle of the syringe should be just inside the meatus, and directed to its upper and posterior part, and before pressing the piston home, the syringe should be steadied by resting it against the thumb of the hand that is holding the ear.

The fluid should be directed against the upper part of the canal, and not directly to the tympanic membrane, and gentle force only should be used at first, the strength of the stream being gradually increased.

After syringing, the canal should be thoroughly dried. To insure removal of all fluid, the patient should bend his head to the side, and then the meatus should be wiped dry with pieces of absorbent wool, introduced with aural forceps or twisted on a probe.

If there be only a little discharge, a piece of cotton-wool is placed lightly in the auditory canal.

Liquid remedies may be introduced into the auditory canal either by saturating a piece of cotton-wool with them and introducing it with a pair of

aural forceps, or by pouring them in directly from the vessel in which they have been warmed.

Before introducing the liquid, the meatus must be thoroughly cleansed either by syringing or with cotton-wool, and if the former method be used, the meatus must be thoroughly dried. The fluid to be introduced should be put into a test-tube, then warmed by placing the test-tube in a bowl of water of the required temperature (105° F.). The patient's head should be laid with the meatus uppermost, and the ear drawn upwards, backwards, and outwards.

The fluid should be allowed to remain for several minutes and then removed by bending the head toward the affected side, or by introducing absorbent wool into the meatus.

Insufflation of Remedies in the Form of Powders.—Powders can be introduced by means of a piece of quill or a glass tube, to the end of which a piece of indiarubber tubing is attached. The powder is then blown into the ear, either by the mouth or with the aid of an indiarubber bag.

Special insufflators are sold, which the patient can use himself.

Operations on the Ear.—Operations are either done through the external auditory meatus, when the only special preparation necessary is the careful syringing out of the canal, or by turning the ear forwards by a posterior incision.

The most common major operation is the opening of the mastoid antrum—a small cavity behind the middle ear—in cases of inflammation, as pus accumulates there.

In preparing a patient for the operation—mas-

toidectomy—the side of the head should be shaved, the hair being removed from an area at least 2 inches in width beyond the bare skin underlying the auricle.

In severe cases, where it is likely that the skull may have to be opened for cerebral abscess, half or all the head should be shaved.

The scalp should be thoroughly washed with soap and water, and then scrubbed with a solution of biniodide of mercury in spirit, 1 in 500.

The auditory meatus should be washed out with a warm solution of biniodide of mercury and water, 1 in 2,000, and a compress applied over the auricle and the adjacent surfaces of the scalp and face.

The patient should be prepared for an anæsthetic in the usual way.

The chief duty of the nurse during the operation will be to keep the surgeon supplied with thin strips of gauze or small swabs, so that he can keep the hole in the bone free from blood.

The after-treatment is the same as that of other operations on the head, and the nurse should watch for the onset of the symptoms of meningitis or cerebral abscess.

Meningitis will show itself by the appearance of rigors, followed by rise of temperature and headache. The pain is often severe, causing the patient to groan and cry out, and there is restlessness, sleeplessness, nausea, vomiting, and intolerance of light and sound. Twitching of the muscles and rigidity of the neck and jaws may be present.

Cerebral abscess is often latent, but the following symptoms should give rise to a suspicion of its presence : Subnormal temperature, a slow and full pulse, slow

respiration, and mental drowsiness, so that the patient takes no notice of things going on around him. The onset of any of these symptoms should be at once reported to the surgeon.

Nursing in Diseases of the Nose and Naso-pharynx.—If solutions are ordered to be applied to the nose without special directions, the spray producer should be used, and preferably one with a single ball, as in this form of instrument the spray can be instantly stopped if the patient coughs. The nozzle is introduced into the nose, and the mucous membrane thoroughly sprayed.

In other cases the **nasal douche** will be ordered. It consists of a vessel holding about a pint of fluid, and of a piece of indiarubber tubing, fitted at one end with an olive-headed nozzle.

The vessel is placed at a higher level than the patient's head, and all air having been expelled, the nose-piece is placed in one nostril. When the fluid touches the upper surface of the soft palate, the latter rises and closes the naso-pharynx. The fluid therefore returns by the other nostril, thus washing out the whole nose and naso-pharynx.

The patient should be directed to breathe quietly through the mouth while the douche is being applied.

Tepid non-irritating fluids are used, and the patient should be erect, with the douche not too far above the head.

Another method of applying solutions to the nose is by means of the syringe. The syringe should not contain more than 2 ounces of fluid, and the stream should be directed straight backward. Only slight force must be used, otherwise fluids may be driven

into the accessory cavities of the nose, and great damage may be done.

Solutions can also be introduced into the nasal cavity by sniffing them up from the hand, or pouring them in from a boat-shaped vessel, with the head well inclined backwards.

Operations on the Nose and Naso-pharynx.—As a type of these operations the removal of enlarged tonsils and adenoids will be taken.

The patient, who is usually a child, is prepared for a general anæsthetic in the ordinary way, and the usual preparations for an operation made.

The nightdress should be slipped down over the shoulders as far as the elbows, and a mackintosh laid under the head and shoulders, and another covering the chest. The hair is protected by the head being covered with an indiarubber cap.

A small sand-bag or pillow should be procured for placing under the patient's head, and the nurse should also prepare a number of sponges or swabs on holders. Immediately after the operation, which only takes a few seconds, the patient should be turned on to his side, so that the blood runs out of the corner of the mouth. The knees should be flexed in order to prevent the patient rolling on his back, and the upper shoulder should be placed a little in front of the lower, so as to give a forward inclination to the whole body. The jaw must be held well forwards, and if signs of asphyxia appear the mouth must be opened with the gag, and the tongue pulled forwards.

The lateral position should be maintained till the patient is well round from the anæsthetic, and he should not be left for a moment during the recovery stage.

As blood is invariably swallowed during these operations, vomiting is common, and some hours after, the patient may bring up a quantity of blood, which need cause no alarm.

When recovery from the anæsthetic is complete, the patient should be allowed to sleep off the effects of the anæsthesia, the lateral position being maintained. Nothing should be given by mouth until the patient shows a distinct inclination for it. As a rule, a little clear soup or Brand's essence should be given first. Milk is to be avoided, as it tends to cling to the raw surfaces, and forms a good culture medium for the micro-organisms.

CHAPTER XIII

OPHTHALMIC NURSING

Conjunctivitis—Irrigation—Buller's shield—Applications to the eye—Operations—After-treatment—Diet—Dressing—Complications—Atropine—Eserine—Cocaine—Leeches—Ointments—Powders.

It is impossible in a book on surgical nursing to take up all the special departments of surgery and write fully on each, for the book would reach unwieldy proportions. In this section it is proposed to deal briefly with points of nursing ophthalmic cases that differ somewhat from those in ordinary surgical practice; but it must be remembered that the principles that govern diseases of the eye and their treatment are the same as those that we have already seen and applied generally.

There is one point of difference that should be constantly borne in mind in dealing with ophthalmic cases, and that is that no strong antiseptics are permissible in eye operations, either for cleaning the part or during the operation, the epithelium covering the eye being exceedingly delicate and easily injured.

Many of the diseases of the eye are due to the presence of micro-organisms; are therefore contagious, and are capable of being carried from person to person. This contagion may be either direct or indirect. Contagion is direct when a particle of septic discharge is

planted in a healthy eye, as may happen when diphtheritic membrane is coughed into the eye whilst examining a throat.

Contagion is indirect when the micro-organisms are conveyed by means of some intermediate means, such as sponges, towels, or fingers. The contagious diseases of the eye are the various varieties of inflammation of the conjunctiva—*i.e.*, conjunctivitis or ophthalmia—and they are all associated with a discharge from the eyes, either mucoid, muco-purulent, or purulent, and the more purulent and abundant the discharge is the more contagious it is likely to be.

Acute Conjunctivitis.—The most contagious form of all is acute purulent conjunctivitis due to the presence of gonorrhœal matter (gonococcus) in the eye. This variety is most usually seen in the newly born, and is due to infection of the conjunctiva of the child during its progress through the maternal passages; but it is also seen in adults, and it may be conveyed to different members of a household by towels or sponges.

Another highly-contagious form of conjunctivitis is that due to the diphtheria bacillus, but fortunately this is rare.

In a person suffering from acute purulent conjunctivitis in one eye the first thing to do is to keep the infection from the conjunctival sac of the other. This may be either done by carefully covering the sound eye with an antiseptic dressing, which has the disadvantage of preventing vision, or by means of a method known as **Buller's shield.** To make this, two pieces of plaster are taken, one 4 inches and the other 4½ inches square, and a circular hole is cut in each. The larger

piece is fastened to the convex side of a watch-glass, and the smaller to the concave side, so that the watch-glass is placed between the two pieces of plaster.

This is then placed on the eye, and carefully fastened well round by strips of plaster, except at the lower and outer side, which is left open to admit air. By means of this shield the patient can use his sound eye freely, and the ventilation prevents inflammation from occurring. It may be worn for many days without change. Buller's shield cannot be worn by young children, and in these cases the eye must be covered with an antiseptic dressing, which it is necessary to change each day. A patient suffering from conjunctivitis must have his own set of washing utensils, towels, sponges, basin, and flannels, and must not use those in common use. In specially contagious cases, sponges and flannels should be discarded for gauze pads, which can be burnt immediately after use. The same applies to all dressings and contaminated materials.

The nurse, in dealing with these cases, must follow the most scrupulous antiseptic treatment of the hands, and the frequent use of the nail-brush is most necessary, otherwise she may infect herself or other patients.

Children suffering from ophthalmia neonatorum (newly born) should not be nursed in the arms, and in applying remedies to their eyes the nurse should stand behind the patient.

If the nurse's or another patient's eyes are accidentally infected, the lids must be at once everted, and the infection washed out with 1 in 10,000 perchloride of mercury solution.

Washing out the Conjunctival Sac.—To do this properly the eyelids must be everted, otherwise the lotion will not reach all parts of the conjunctiva. The lower lid is everted by merely drawing the skin just below the eye downwards with the forefinger, but the eversion of the upper lid is more difficult.

The nurse should stand behind the patient and tell him to look downwards. The lashes of the upper lid are held between the thumb and forefinger, and drawn downwards and outwards. The nurse then places the forefinger of the other hand on the upper part of the lid, twists it quickly round the finger, and the lid is everted. The lotion is then applied to the lids by squeezing it out of a piece of wool, and the liquid is allowed to remain in contact with the lids for some moments. Another plan is to wash out the sac by means of a douche-tin and nozzle, and this is successful in practised hands, but there is a danger of injuring the eye if a glass nozzle be used.

Syringing is not advisable, as it is difficult to control the stream, and pus can be easily squirted into the nurse's eye, and cause infection, or the nozzle of the syringe may scratch the eye and injure the globe.

In cases of conjunctivitis in young children it will usually be necessary to use a retractor to separate the lids, but the nurse should not use one except under special orders, as damage to the eye may occur if one is not skilled in its use.

To apply Drops to the Eye.—If these are given for affections of the conjunctiva, they are applied in the same way as lotions—by everting the lids, but in smaller quantities. But if it is desired for them to act on the other parts of the eye, a different method

is used. The patient is told to look upwards, and then the lower lid being gently everted, the fluid is allowed to drop into the exposed conjunctiva, one of the forms of drop-bottle being used. It is important to remember that on no account must the nozzle of the bottle touch the lids or eyeball, and that the bottle should be held vertically. If no bottle is at hand, the drops can be run out from a tube of clean note-paper, or applied with a camel's-hair brush.

If the patient be a child, and not amenable to reason, he is laid flat on his back, and a pool of the fluid is poured into the inner canthus of the eye. The child is then prevailed upon to open the eye, and some of the fluid is sure to enter.

Many of the remedies used are very powerful, and the nurse must be careful to wash her hands after using them, otherwise she may find that after giving drops of atropine her own pupils will become dilated, owing to her conveying the alkaloid to her own eyes on her fingers, and although this will do no serious harm, yet it may prevent her from working or reading for some days.

Ophthalmic Operations. — In preparing a patient for ophthalmic operations the same details as to room, operating-table, etc., should be attended to as in other surgical operations, and in this place only the special points necessary to remember will be alluded to.

The instruments are sterilized by boiling for ten minutes in a 1 per cent. solution of bicarbonate of soda, and are then placed in boracic acid lotion, weak carbolic lotion (1 in 100), saline solution, or are kept dry. Stronger antiseptics should not be used.

The surgeon will test the knives and other cutting instruments before use on a trial drum, which consists of a piece of kid stretched over a small frame, and after they are tested they should be boiled for one minute, being secured in a rack in the sterilizer, so that they do not bump against the bottom. An irrigator with a glass nozzle should be filled with warm saline fluid (1 dram to 1 pint) or warm boracic lotion.

In preparing the patient an aperient should be given on the morning of the day before the operation, and repeated if necessary. The night before the operation a bath should be given, or a thorough wash in bed, special care being taken of the head and hair, which must be scrupulously clean. Any discharge from the ears or nose, or any sore on the head, must be noted, and the surgeon informed. The face should be thoroughly washed again in the morning, plenty of soap being used, and it is as well to clip the eye-lashes short.

About one hour before operation both sides of the face should be carefully washed with soap and water, using sterilized pads to dry it, and finally cleaned with boric or weak (1 in 100) carbolic lotion, special attention being paid to the corners of the eyes and the eyebrows.

A sterilized pad wrung out in boric acid lotion is then fastened over the eye to be operated upon by a single turn of bandage.

The hair of female patients should be carefully smoothed, and either arranged low down on the nape of the neck or on the top of the head, and it should then be covered with a closely-fitting cap of jaconet or indiarubber.

If a general anæsthetic is to be given, as is always

the case for glaucoma, no food should be given after breakfast, as it is most important to prevent vomiting; but in cases where local anæsthesia is used, as is usually the case in cataract, a light breakfast is given, and if the operation is to take place in the afternoon milk or beef-tea may be given at ten o'clock and again at one o'clock.

If cocaine is to be used for local anæsthesia a freshly-prepared 2 per cent. sterilized solution of cocaine is obtained. A few drops should be placed in both eyes about fifteen minutes before the arrival of the surgeon, and this is repeated every five minutes in the eye that is to be operated on. The patient should be directed to close the eyes, and a sterilized pad should be placed on the lid.

All lotions used in eye operations should be freshly prepared, and the ointments should be freshly obtained in little tubes similar to those used for artists' colours, and a fresh tube should always be opened for the operation.

The swabs used for sponging should be sterilized and wrung out in warm boracic acid lotion or saline solution.

The dressing generally used is a sterilized eye-pad made of gamgee tissue, and cut into a circular pattern. A little ointment, such as boric, or one containing atropine, is smeared on the centre of the pad, and the whole secured by a couple of turns of bandage ($1\frac{1}{2}$ to 2 inches wide).

Some surgeons prefer one of the forms of sterilized gauze to gamgee tissue. Plain cotton-wool or lint should not be placed next to the eye, as small particles are apt to get between the lid and irritate the conjunctiva.

After-treatment.—Under this heading will be discussed the after-treatment of an operation case in which the anterior chamber of the eye has been opened—for example, an iridectomy done for glaucoma or the removal of a cataract.

The patient, with both eyes bandaged, is put back into bed, and, whether an anæsthetic has been given or not, is kept in the dorsal position.

The head is placed between sand-bags so as to be kept still, but if the patient is amenable to treatment they may be dispensed with in the daytime after twenty-four hours.

The patient should be warned against touching the bandages, and it is well to loosely tie the hands at night to prevent unconscious interference.

Diet.—It is of the utmost importance that vomiting should not occur, and the diet should be light for the first forty-eight hours, consisting of milk, bread and milk, beef-tea, arrowroot, and light milk puddings, or milk only for the first twenty-four hours, if an anæsthetic has been given.

More solid diet should not be given till the bowels have been opened, and then a little mince or carefully-prepared fish may be added to the dietary. Solid food should not be given for a week after the operation.

As many patients who are operated upon for cataract are old or broken down in health, alcoholic stimulants are sometimes ordered, but should only be given under the special directions of the surgeon.

The patient must always be fed by the nurse until one eye is uncovered.

It is important that the patient does not strain after these operations, so no aperient is given till the third

morning after the operation, when any usual purge is given, followed by an enema if necessary. A bed-pan must, of course, be used and the patient not allowed to sit up.

After the bowels have been opened, the patient may be allowed to lie on the side that has *not* been operated upon, and if all goes well he may be allowed up for a short time on the fifth day, and by the tenth day may be considered convalescent.

Dressing.—Every time the eye is dressed the most rigid antiseptic precautions must be observed, as rigid as at the time of the operation.

The first dressing is usually done in twenty-four hours. The necessary things being got ready, and the bandage removed, the hands are carefully sterilized, and the dressing is then removed with forceps. If it is 'stuck,' it should be loosened by soaking it with warm boracic lotion, and when removing it the patient should be warned to keep quite still, and not to attempt to open the lids until told to do so. Any discharge present is wiped away with sterilized swabs soaked in boracic lotion. If ordered, atropine or other drops should now be applied, and these should always be sterilized or freshly prepared.

A little simple ointment is now placed upon the edges of the lids, an aseptic pad placed over the eyes, and a new bandage applied.

The nurse should make it a rule to brush the patient's hair both before and after the application of the bandage.

The dressing should be changed once in twenty-four hours, if it is not necessary to apply atropine more often, and on the sixth day the eye that has not been operated upon may be left uncovered.

At the end of ten days no dressing is, as a rule, necessary, and the bandage is replaced by a shade.

Complications.—1. **Vomiting.**—Should vomiting occur, the patient must be kept without food, and perfectly quiet; a mustard-leaf applied to the epigastrium may be useful. But if the vomiting does not rapidly pass off the surgeon must be acquainted with the fact.

2. **Discharge** may soak through the dressing before twenty-four hours have passed. In these cases the nurse should not disturb the dressing, but should sprinkle it with iodoform or boracic powder, and then apply a fresh pad on it. In hospital the house surgeon should be informed.

3. **Old people**, especially with coughs, cannot be confined to bed in the same way as younger patients can be, and it is often necessary to relax the rules as to the dorsal position, etc., and to comfort the patient by slight changes of the position in bed, and by arrangement of the pillows. In bad cases it may even be necessary to allow the patient to sit up in a chair, otherwise hypostatic pneumonia may supervene and shorten the patient's life.

4. **Delirium** will occasionally follow an operation on the eye, especially in patients addicted to alcohol or when there is a hereditary tendency to insanity.

5. **Iritis.**—Inflammation of the iris is due to septic micro-organisms, and usually manifests itself about the third day after operation. The symptoms are rise of temperature, pain, swelling, and redness of the lids, and a watery discharge from the eyes, glueing the lids together. The treatment consists of leeches to the

temples, hot fomentations, and atropine drops. If suppuration occurs the discharge is purulent and the eyesight is generally lost.

Atropine.—This is the drug that is most commonly used in ophthalmic practice both before and after operations. It is the active principle of belladonna, and its action when dropped into the eye is to cause dilatation of the pupil.—*i.e.*, mydriasis. It is used in solution of 2 or 4 grains to the ounce twice a day. If ordered to be put in one eye, it should be noted that it has its physiological effect, otherwise it must be used more frequently; and if dilatation of the pupil still does not follow the surgeon must be informed.

Homatropine is also obtained from belladonna, and its action is the same as that of atropine, only its effects usually pass off in twenty-four hours, whilst the pupil does not regain its ordinary condition for about fourteen days after the use of atropine.

It is a more costly drug than atropine, and should be used where a temporary effect only is desired. Neither should ever be used in old people without special orders, as glaucoma may follow their use, and in cases of glaucoma these drugs are never used.

Whilst under the action of these two alkaloids, the eye cannot be used for near work, such as reading or sewing.

Atropine, even when used as eye-drops, may cause symptoms of belladonna-poisoning. These are:

1. Dryness of the mouth.
2. Redness and swelling of the eyelids.
3. Delirium, especially at night.
4. If long continued—conjunctivitis.

If any of these symptoms appear during a course of

treatment with atropine, the drug should be stopped and the surgeon informed of the occurrence.

Eserine or Physostigmine is used in solutions of 1 grain to the ounce, and is a powerful contractor of the pupils (myosis). If a drop be placed in the eye, the pupil rapidly contracts to a pin-point, and will not dilate in the dark. It is used in glaucoma and in some forms of corneal ulcer.

Cocaine is used as a local anodyne (*i.e.*, relief of pain) in various operations on the eye. It is the active principle of the coca plant, and is used in solutions of 10 or 20 grains to the ounce (2 to 4 per cent.).

Fluorescine is obtained from coal-tar, and is used solely for diagnostic purposes. It stains the cornea a vivid green if ulcerated, but has no action upon the healthy cornea. It has no ill effects, and the staining quickly passes off.

Leeches.—In ophthalmic work these are applied to the temple, the forehead, the side of the nose, or behind the ear, and not to the lids or conjunctiva, where there may be difficulty in arresting the flow of blood.

The 'artificial' leech is a form of wet-cupping. Punctures in the skin of the temple are made with a special instrument or with a scalpel, and the blood is then withdrawn by applying the cupping-glass.

To apply Ointments.—A camel's-hair brush is dipped in the ointment, the lower lid being everted with the finger; the brush is drawn along from the inner to the outer corner of the eye. The brush must only be used for one person, and disinfected each time before use.

Powders can be applied in the same way.

CHAPTER XIV

FRACTURES

Definition—Varieties—Separated epiphyses—Method of union—Signs—Treatment—Extension—Cradles—Splints—Plaster of Paris—Starch—Gum and chalk—Operation—Compound fracture—Special fractures—Time of union.

Definition.—A fracture is the solution of continuity in a bone suddenly produced.

Causes.—Fractures are caused in three ways :

1. Direct violence—that is, the bone is broken where the fracturing force is applied ; *e.g.*, fracture of the tibia by being run over.

2. Indirect violence. The bone is fractured by a force applied at some other place, and transmitted along the limb to the seat of fracture—*e.g.*, fracture of clavicle due to a fall on the outstretched hand.

3. Muscular violence, the bone being broken by sudden forcible contraction of the muscles—*e.g.*, fracture of the humerus whilst throwing, and the common transverse fracture of the patella due to sudden contraction of the great muscles of the thigh to save one's self from falling.

Varieties—(*a*) *Simple.*—The bone is broken ; there is no external wound and no other gross lesion.

(*b*) *Compound.*—There is an external wound leading to the seat of fracture either through the skin or

mucous membrane, so that the ends of the fragments communicate with the external air.

(*c*) *Comminuted Fracture.*—In this fracture the bone is broken into three or four pieces.

(*d*) *Complicated Fracture.*—Besides the fracture, there is some severe injury to nerves, vessels, joints, or other viscera.

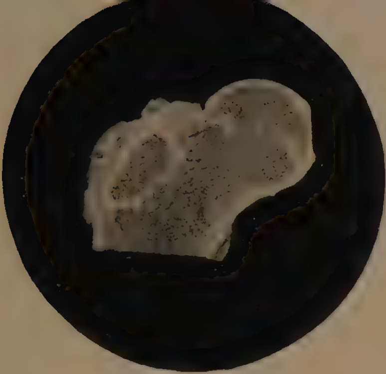
(*e*) *Greenstick Fractures.*—These are only found in children, and usually in children suffering from rickets. The bone is partially bent and partially broken, the break being on the convexity of the bend, in the same way that a stick cracks on being bent across the knee.

(*f*) *Spontaneous Fracture.*—The violence which causes the fracture is not sufficient to break a normal bone; some local bone disease or general disease is present, causing the bones to be more brittle than usual—*e.g.*, a sarcoma growing in bone. Spontaneous fractures also occur in certain forms of insanity. These last are important, as fracture may occur in the management of lunatics without undue violence being used, and lead to grave, unfounded accusation against the nurse or attendant.

(*g*) *Impacted Fractures.*—In these fractures one of the fragments is driven into the other, and is so wedged in that they cannot be separated except by violence.

Separated Epiphyses.—With fractures must also be taken a lesion which only occurs in patients under the age of twenty, and requires the same treatment and nursing as fractures—namely, separated epiphyses.

The epiphysial line is a layer of cartilage found near the extremity of the long bones, and from which the bones grow. The part of the bone beyond the line of cartilage is called the epiphysis, the other part the



NORMAL BONE OF A YOUNG SUBJECT.

UPPER END OF THE FEMUR SHEWING THE EPIPHYSEAL LINES AND EPIPHYSES.

UNION OF BONE AFTER FRACTURE.

(A) EXTERIOR OF BONE SHEWING CALLUS AND DEFORMITY AFTER FRACTURE
(B) INTERIOR OF SAME BONE SHEWING THE CALLUS.

diaphysis, and in children indirect violence applied to a bone will usually cause a separation to occur through the cartilage between the diaphysis and epiphysis. As the growth of the bone occurs in this cartilage, serious alterations in length may occur after these injuries; but with proper treatment union may be perfect, and no serious after-results will follow. From the nurse's point of view fractures and separated epiphyses may be dealt with together.

Union of Fractures.—A long bone consists of a layer of compact tissue covered by a firm fibrous membrane from which it derives its blood-supply—the periosteum. At the end of the bones the tissue is loose, looking like a piece of sponge—cancellous tissue—and in the centre of the bone is a canal—the medullary cavity—containing the bone-marrow. Immediately after the fracture the two ends of the bone are found embedded in blood-clot, the periosteum being torn. The injury excites inflammation in the surrounding tissue, which is followed by the formation of granulation tissue (see repair of wounds, p. 38). This granulation tissue is found outside and under the periosteum, and between the two ends of the bone filling up the medullary cavity. Granulation tissue is generally well formed by the tenth day, and the blood-clot has disappeared. Bony salts are deposited in this granulation tissue, so that the two ends of the bone are soon joined by a mass of soft, sponge-like bone. This is known as the callus, and consists of two portions—the part surrounding the ends of the bone, which will ultimately become absorbed, and known as the provisional or temporary callus, and the part between the ends of the bone, known as the permanent or definitive

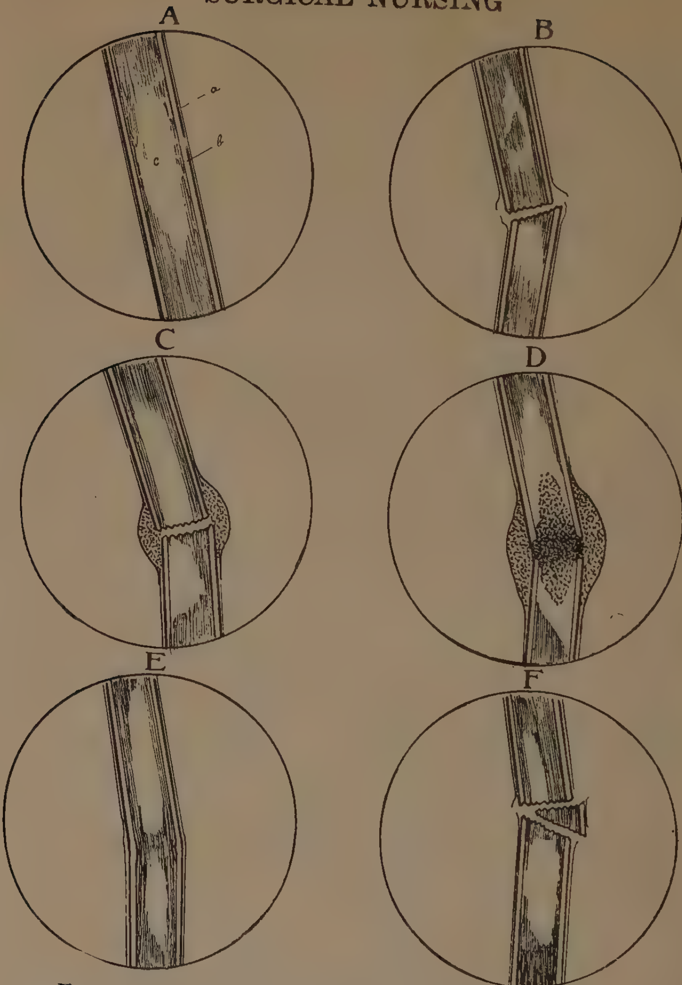


Fig. 16.—Diagram of Union of a Simple Fracture.

A Normal bone—*a*, periosteum; *b*, compact tissue; *c*, medullary cavity. B, Fracture, periosteum torn. C, Formation of temporary callus, periosteum joined. D, Temporary and permanent callus. E, Bone united with some deformity. F, Comminuted fracture.

callus. The better the apposition or setting of the fragments, the more perfectly will the two bones be joined together, all unnecessary callus being absorbed and the medullary canal reopened. If the union has been very good, it will be impossible at the end of a year to tell that the bone has been fractured.

Signs of Fracture.—1. The presence of bruising and localized pain.

2. Loss of power.

3. Abnormal mobility in the course of the bone.

4. Deformity.

5. Alteration in measurements, usually shortening.

6. Crepitus. This is heard and felt by rubbing the two ends of the bone together. As a rule, it is unwise to try and obtain this sign—if the fracture can be diagnosed by the others—as damage to important structures may be done.

At the present day the diagnosis of fracture is made exceedingly simple by the use of the X rays, and the surgeon will usually use radiography both in diagnosis and treatment of fractures.

First Aid in Simple Fractures.—The diagnosis should be made by the signs given above, but if there is any doubt as to whether a bone is fractured or not, the case should always be treated as if the more serious injury had occurred until an authoritative opinion is obtained.

Principles of Treatment.—These are to avoid making it compound, and to give the patient as little pain as possible. If the lower extremities be injured, the patient must be kept lying down, and on no account allowed to make any attempt to walk. The patient's

clothes should not be removed, and one person should have sole control of the injured limb, grasping it above and below the supposed seat of fracture, so as to support both ends of the bone, and maintaining slight traction. The ends of the fragments should be fixed by temporary splints, which should always control the joints above and below the fractured bone—*e.g.*, in fracture of the tibia the knee and the ankle must be rendered immobile by splints, and in the forearm the elbow and wrist. Temporary splints can be formed from pieces of wood—walking-sticks, umbrellas, folded newspapers, etc. For bandages, handkerchiefs and scarves can be substituted. If the fracture be of the upper extremity, after the application of splints it should be supported in a sling, and the patient may be allowed to walk.

The bed for nursing a case of fracture should be narrow, so that the patient can be got at from both sides. It should have a firm mattress—horsehair for choice—and in fractures of the lower extremity should be kept level by placing fracture-boards under the mattress. These fracture-boards can readily be extemporized from ordinary deal planks, black-boards, etc. From the ceiling above the bed should be suspended a pulley, so that the patient can assist the nurse by pulling himself up with his arms.

In undressing the patient, the garments should be removed from the sound limb first, and if undressing is at all difficult the clothes should be cut off along the seams. If possible, the temporary splint should not be removed until the patient is undressed in bed. If it has been necessary to remove the temporary splints, the limb should be covered by a fracture-cloth, and kept quiet and in a good position between sand-bags—a cradle taking off the weight of the bed-clothes. In

fractures below the knee the leg is best kept lying on its outer side with the knee well bent.

After the fractured limb has been well washed with soap and water, it may advantageously be sponged with 1 in 1,000 perchloride of mercury, then dusted with boracic powder. This will prevent the decomposition of sweat, and so prevent the itching of which patients often complain.

The surgeon will now proceed to 'set' the fracture. By this is meant the apposition of the two fragments so as to get rid of all deformity, and it is done by the application of two principles:

1. Preventing the muscles from acting, and removing the force of gravity.
2. Extension, which is maintained as a rule by the weight and pulley.

Extension.—The extension apparatus commonly used consists of two broad bands of strapping connected together by means of a piece of wood in the centre of which is bored a hole, and which is slightly broader than the sole of the foot. The two bands lie on each side of the limb, nearly up to the seat of the fracture, the piece of wood being about 3 inches from the foot. The bands are fastened to the limbs by strips of strapping, which should be evenly applied to the limb from below upwards, each strip overlapping by about two-thirds the one below. A layer of gamgee tissue should protect the bony prominences of the malleoli from being cut by the plaster. A cord passes through the hole in the piece of wood and over a pulley fixed at the end of the bed, and to the other end of the cord is attached a weight. The amount of weight necessary is determined by the

surgeon, and should be applied at the time that the fracture is set, and should *not* be removed for any purpose unless by the surgeon's orders.

During the nursing of a case of fracture with extension three things should be carefully noted :

1. That the weight is pulling in the line of the fractured bone.

2. That the weight is not resting against anything or touching the floor.

3. That the patient's foot or the splint is not resting against the end of the bed.

Cradles.—These are used in fractures of the lower extremity which are not treated by extension. They

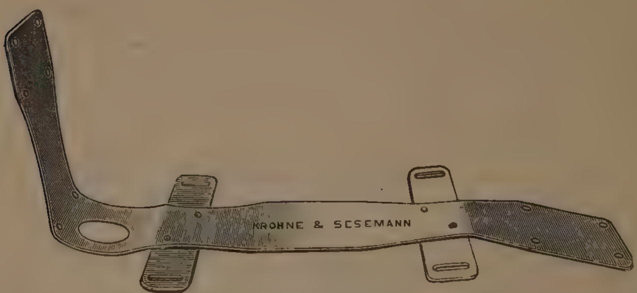


FIG. 17.—NEVILLE'S SPLINT FOR SLINGING IN A BLOXAM CRADLE.

are of various patterns, the most common being Bloxam's, or some modification of it. In these cradles the limb is kept swinging on a splint with the knee flexed. As the leg is uncovered by the bedclothes it must be kept warm by a sheet of gamgee tissue or a small blanket.

Various forms of splints are used in the treatment of fractures, and they should be padded in the manner already described (see Inflammation).

Special forms of splints commonly used are: 1. **MacIntyre's splint,** for fracture of the femur or tibia. This is a metal splint consisting of two parts, which can be adjusted at any angle to one another by means of a screw underneath.

2. **Liston's long splint,** for fractures of the femur, which fits along the whole length of the body, extending from the axilla to below the foot.

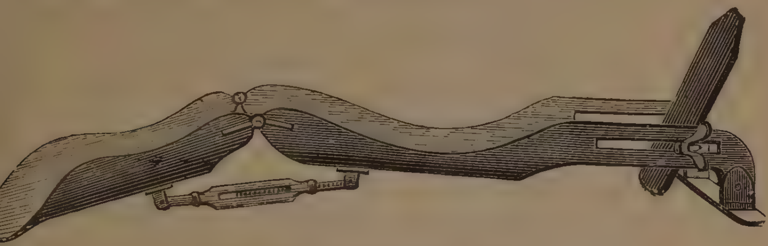


FIG. 18.—MACINTYRE'S SPLINT.

3. **Cline's Splints.**—These are splints shaped to the leg, and are used in fractures of the tibia and fibula.

4. **Sharp's or Roughton's splints** are used in Pott's fractures, being placed on the outer side of the limb.

5. **Hodgen's splint,** for fractures of the femur, consists of an iron frame and extension apparatus. The limb is supported on strips of house flannel, and extension is kept up by means of pulleys.

Besides the treatment by movable splints already described, forms of fixed apparatus are either applied from the first or as a supplement to the use of splints. The most important of these are plaster of Paris bandages, Croft's splint, silicate of soda bandages,

starch and millboard splints, and gum and chalk stockings.

All these can be used either as fixed apparatus or be suitably modified and be made into movable splints

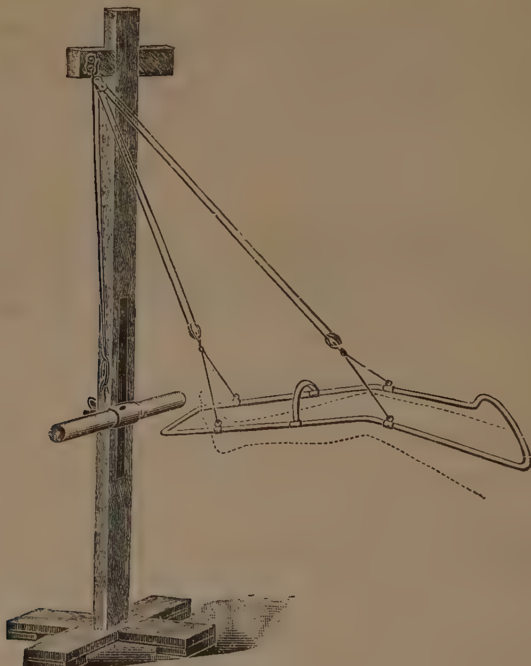


Fig. 19.—Hodgen's Splint.

During the nursing of a fracture the nurse has three important duties to attend to :

1. To ascertain if there is any excessive pressure from splints or bandages.

This will be seen by noticing the colour of the limb below the bandage, and the presence of any swelling.

It is particularly to be noted whether the colour of the limb is quickly restored after light pressure of the finger. Pain will often be complained of, but not necessarily so, and gangrene may occur from tight bandaging without any pain being complained of after the first few hours, especially if the fracture has been set under anæsthesia.

2. To maintain the extension and to keep the patient still, in the proper position.

3. The prevention of bed-sores (see p. 229). The prevention of bed-sores in fractures is often particularly difficult, especially if the patient gets traumatic delirium or delirium tremens. In either of these conditions there is a total disregard of pain, the patient will be extremely restless, and it will tax the whole ingenuity of the nurse to keep him still, his splints on, and to prevent bed-sores.

Plaster of Paris Bandage.—To make a plaster of Paris bandage, take a soft crinoline muslin bandage, and rub dry plaster of Paris into both sides with the palm of the hand. Loosely roll the bandage by hand, and keep it in a jar in a dry place.

A limb on which a plaster of Paris bandage is to be applied should be shaved if necessary, thoroughly washed, and then sponged with 1 in 1,000 perchloride of mercury. It is then dried and lightly covered with boracic powder.

Two basins are got ready, one containing warm water sufficient to cover the plaster bandage when it is standing on end, and the other for making a cream of plaster which must be prepared just before use. If it is necessary for the plaster to set quickly salt should be added to the water.

A bandage should be placed on end in the first basin, and then the whole of the surface to which the plaster is to be applied is covered with a flannel or domette bandage, put on without reverses or figure-of-eight turns.

Another bandage is put in the water to soak, and the first is quickly applied to the limb by a series of spirals, no reverses being used, and the bandage allowed very much to follow its own course. The first bandage must be put on loosely.

While applying the bandages, and until the plaster is complete, an assistant must hold the limb in the proper position, and usually this is with the foot at right angles to the leg.

The second bandage is now applied, a third being placed to soak in the meantime, and so on till the plaster case is considered firm enough. A cream of plaster is now made in the second basin by slowly mixing 15 ounces of plaster with ½ pint of water, and this is well rubbed into the plaster bandage and smoothed carefully.

The limb is held for five minutes longer in the correct position by the assistant, and is then placed on the bed and surrounded by hot-water tins without covers till it is quite dry. If there be a sore on the limb a window should be left in the plaster over it, so that it can be dressed, and the edges of the window should be painted with Friar's balsam to prevent them from crumbling away. In children it is an excellent plan to give the plaster when dry a coat of spirit varnish, as this will prevent the urine from soaking into it.

To Remove a Plaster of Paris Bandage.— For this purpose there are several instruments made

which are either shears or saws designed for cutting through the plaster, which is afterwards wrenched off.

Another method of removal is to rub a little dilute hydrochloric acid along one side of the plaster. This will soften it, and allow it to be cut with scissors.

When putting on a plaster bandage it is well to cover the hands with vaseline, as the plaster will then be easily cleaned off, or a little crystalline sugar may be used instead of soap for washing the hands after the plaster is finished.

Croft's Plaster Case.—To make this form of plaster splint the following are necessary :

1. Four pieces of well-shrunk house flannel. These are cut out to the shape of the leg and foot, special care being taken that the foot-piece is at right angles to the leg-piece, and that when wrapped round the limb they just meet in the middle line both back and front.

Fig. 20.—Pattern of Flannel for Croft's Plaster.

2. Four pieces of lint cut in the same way, and slightly larger than the flannel.

3. Three basins, one filled with hot water, and the other two ready to make plaster of Paris cream in. This cream is made by stirring 15 ounces of plaster into $\frac{1}{2}$ pint of water.

4. Two linen bandages and some olive-oil.

The leg is shaved, cleaned, and oiled. Two of the pieces of house flannel are put into the basin of

hot water, and while they are soaking, one of the pieces of lint is wrapped round the inner side of the limb, and is made to fit smoothly by making cuts in the lint where necessary.

The assistant holds this piece of lint on the leg in the proper position, and the two pieces of flannel are taken separately, well soaked in the plaster of Paris cream, which a second assistant has prepared, and quickly applied one over the other to the inner side of the limb evenly and smoothly. More of the cream is rubbed in, and the second piece of the lint applied over the plaster.

A bandage is quickly applied to bind the case on to the limb, so that when the plaster sets an exact cast of one-half of the leg is taken.

A cast of the outer side of the leg and foot is made in exactly the same way before the first is removed, and the two kept bandaged on for twenty-four hours, hot-water tins without covers being placed in the bed to hasten drying.

On cutting the bandage and removing the casts, it will be found that they form the two halves of a firm splint exactly fitting the limb.

Silicate Splints.—Water-glass or silicate of soda is also used to make fixed splints, and has the advantage of being much lighter than plaster, but it takes twenty-four hours to harden. The limb is prepared as for plaster. Two to four thicknesses of open-wove bandage soaked in a solution of silicate of soda are used in the same way as plaster of Paris bandages.

Starch Splints.—The limb is surrounded by some antiseptic wool made into rollers and applied like an ordinary bandage. Over this are moulded splints

made of bookbinders' millboard well soaked in hot water and saturated with a strong starch solution, the splints being placed in position on the leg by pieces of bandage, which are to be removed as the starch bandages are applied.

Stout unbleached calico bandages are soaked in hot water, wrung dry, drawn through a strong solution of hot starch, and then rolled up. They are at once applied over the millboard splints, three or four thicknesses being used. The bandages take about forty-eight hours to dry, and the splint is fairly light and rigid. Like a Croft's splint, it can be cut down the middle, removed, and reapplied with bandages, so that the limb can be massaged at will. Eyelets can be inserted if it be desirable to lace the splint.

Gum and Chalk Stocking.—When this is ordered to be applied the following things must be got ready.

1. Three stockings, the first fitting the leg, the next slightly larger, and the next a little larger still. The toes are cut off.

2. A solution of gum and chalk. This is made by adding to 1 pound of powdered chalk 15 ounces of a solution of gum. The gum is poured over the chalk, and left to stand all night. In the morning it is thoroughly mixed.

3. A piece of tape about twice the length of the leg.

4. A piece of paraffin wax in a porcelain dish, and a spirit-lamp to melt it.

5. A cradle for slinging the leg.

6. Some olive-oil.

To Apply.—The leg is shaved, cleaned, and rubbed over with the olive-oil. The tape is run through the melted paraffin wax, and then placed along the anterior

surface of the leg. The first stocking, turned inside out, so as to present a smooth surface to the limb, is put on over it, and the gum and chalk solution rubbed thoroughly into the meshes, an assistant holding the limb in the proper position. The second stocking is then put on over the first, and another layer of gum and chalk thoroughly rubbed in. This is repeated with the third stocking, and all the gum and chalk should have been used if the leg be of average size.

The limb is now slung to the cradle by means of the tape, and suspended in the correct position. Hot water tins without covers are placed near it, and it is left all night to dry.

In the morning it will be seen that there is a ridge down the centre where the tape is, and the stocking should be cut along this ridge with a stout pair of scissors and removed. If not yet quite dry, it must be stood near the fire. The edges of the stocking are now trimmed, and bound with lead strapping, and eyelet holes are made down the front, so that it can be laced up. The advantage of this stocking is that it can be removed, and the leg massaged if necessary, and it is exceedingly neat. Its disadvantage is the pain its application causes if the fracture be recent, and the danger of re-fracturing the bone in the somewhat difficult task of putting on the second and third stocking.

Under certain conditions the surgeon may decide that treatment by means of splints will not be sufficient, or splint treatment may have been tried and resulted in failure. An operation will then be undertaken to secure union of the fragments, and will take the form of wiring, pegging, or screwing the ends of the bone together.

There are no special preparations for the nurse to make in these cases. After the operation, splint treatment will usually have to be carried out, and union is not, as a rule, hastened by operation.

Compound Fractures, First Aid.—The first aid is the same as for a simple fracture, with the addition of first aid to wounds which has already been described (see p. 44).

In cases of compound fracture it is particularly essential that as little interference as possible takes place, and that the fragments should be kept tightly fixed together. The two dangers to be feared are damage by the fragments and sepsis.

The principles of the after-treatment will be an attempt to convert a compound into a simple fracture by cleaning the wound, rendering it aseptic, and stitching it up. If this is impossible, the wound will have to be drained, and the splints should have an interruption opposite the wound, to avoid pressure and to facilitate dressing. It is well in these cases to cover the splints with jaconet, to prevent blood and discharge soaking into the padding and there decomposing.

Fractures in Different Parts of the Body.

Fractures of the Jaw.—These fractures are nearly always compound, the mucous membrane of the mouth being torn. The mouth must be kept as aseptic as possible by one of the methods described under operations on the mouth (p. 170).

If the patient is not allowed to open the mouth, he must be fed with a feeder and tube, the tube passing

through a gap in the teeth or introduced behind the last molar.

Fractured Ribs.—The patient is often allowed to go about with the ribs strapped, but if many ribs are fractured he is kept in bed, and must be propped up in a sitting position either by a bed-rest or pillows. The great danger to be apprehended is broncho-pneumonia, from the inability of the patient to cough, and so to get rid of his bronchial secretion.

Fractures of the Forearm.—After these fractures the patient is usually allowed to walk about, unless the shock is severe.

Fractures of the Spine.—These will be dealt with in a separate chapter.

Fractures of the Pelvis.—Usually necessitate rest in bed from eight to twelve weeks. In moving these patients as much care must be taken as in nursing a case of fractured spine.

Special Fractures.—The following are the most important of the special fractures for a nurse to know :

(1) Colles's, (2) Pott's, (3) intra-capsular fracture of the neck of the femur, (4) fractured patella.

1. **Colles's fracture** is a fracture and dislocation of the lower end of the radius, usually occurring in elderly women from falls on the outstretched hand. There is a characteristic deformity which has been compared in shape to a dinner-fork, and which is reduced by the surgeon. It is most important in these cases that the fingers should not be allowed to become stiff, otherwise permanent disablement will

result. Stiffness is prevented by encouraging the patient to move the fingers, and by massage and passive movements.

2. **Pott's fracture** is a fracture of the lower end of the fibula, with dislocation of the foot outwards and backwards. It is due to indirect violence, generally by the patient slipping on the kerb. The same precautions must be taken to prevent stiffness and loss of power as in Colles's fracture.

3. **Intra-capsular fracture of the neck of the femur** generally occurs in old women from slight indirect violence, such as tripping over the ridge of

FIG. 21.—CARR'S SPLINT FOR COLLES'S FRACTURE.

the carpet. The patient, as a rule, being old and liable to hypostatic pneumonia—*i.e.*, pneumonia due to stagnation of the blood in the lungs—is not usually kept in bed for more than two or three days. The limb is made comfortable by placing a fracture-cloth over it, and steadying it on each side with sand-bags. When the swelling has disappeared, some form of fixed apparatus is generally applied, and the patient got up.

4. **Fractured Patella.**—At the present time the majority of these fractures are treated by operation, the fragments of the bone being wired together. As soon as the stitches are removed, massage and passive movements are started.

Average Times for Union of the Various Bones after Simple Fractures.

Phalanges	2 to 3 weeks
Metacarpal, carpal, metatarsal, tarsal, ribs..	3 ,, 4 ,,
Clavicle, forearm bones, fibula	5 ,,
Humerus and tibia	6 ,, 7 ,,
Tibia and fibula	8 ,,
Femur	10 ,, 12 ,,

Compound fractures, as a rule, take longer.

CHAPTER XV

FRACTURED SPINE

Spinal column—Spinal cord—General considerations—Symptoms—Treatment—Bed—Shock—Asphyxia—Cystitis—Bed-sores—Incontinence of urine—Laminectomy.

The spinal column consists of a series of thirty-three bones called vertebræ, which are in the form of firm, thick, irregular rings.

These bones are placed one above the other, and are held together by muscles, ligaments, and by pads of cartilage between the bones called the intervertebral discs. This column is surmounted by the skull, and it is attached to the pelvis below, with which the lower limbs articulate.

The vertebræ are divided up into the following series :

1. *The cervical* (7), which form the neck. These are small, and the individual bones are loosely articulated together, so that considerable movement is allowed.

2. *Dorsal* (12). These carry the ribs, and help to form the large cavity called the thorax.

3. *Lumbar* (5). These are large, strong vertebræ, and are found in the loins, and do not move much on each other.

4. *Sacral* (5). These are welded together into one

piece of bone—the sacrum—which forms part of the bony ring of the pelvis.

5. *Coccyx.* These four rudimentary vertebræ at the end of the spinal column represent the tail in the lower animals.

The rings of bone, when joined together, form a canal—the spinal canal—in which the spinal cord lies. This cord extends from the first cervical vertebra to the second lumbar, and is part of the central nervous system.

The central nervous system consists of the brain and spinal cord, the brain being enclosed in the skull and forming the higher part of the nervous system, the cord in the spinal canal being the lower.

From the spinal cord there come off, by two roots, an anterior and a posterior, thirty-one spinal nerves—eight cervical, twelve dorsal, five lumbar, five sacral, and one coccygeal. These nerves come out from the spinal canal on each side between the bodies of the vertebræ, and run to all parts of the body.

They contain three principal sets of fibres:

1. Coming out by the anterior roots are the motor nerve fibres going to the muscles, by means of which the muscles can be made to contract.

There is, in consciousness, a desire to perform a certain movement. An impulse is started in the brain, and passes down a nerve fibre in the spinal cord till it comes to a nerve cell, which is connected by means of another fibre with the muscle that it is desired to contract. The impulse passes down the new nerve fibre, stimulates the muscle, which contracts, and the movement is performed.

If from any cause this path from the brain to the muscle is interrupted, it will be impossible to con-

tract the desired muscle, and no movement can take place.

2. The sensory nerve fibres start in special sense-organs in the skin. When one of these minute organs is stimulated by a touch, a prick, heat or cold, a stimulus passes up the nerve, and enters the spinal cord by means of the posterior root. Here it passes on its stimulus to a nerve cell which is connected by means of another nerve fibre with the brain, and the stimulus having reached the brain, one is conscious of a sensation having occurred in the part stimulated.

If the sensory path be interrupted, no stimuli can reach the brain, and we remain unconscious of any sensation, however severe the stimulus may be.

3. There is also another important set of nerve fibres coming from the brain which presides over the nutrition of the various parts of the body. If these nerve fibres be interrupted in their course, the part is cut off from the central nervous system, and it is no longer able to resist the action of slight injuries. These are called the trophic nerves, and if, for example, the trophic nerves going to a piece of skin be destroyed, that skin will easily become inflamed, and will slough from slight injuries which would not affect the normal skin.

A special form of the motor nerves are those which supply the muscles of the arteries and veins. These are known as the vaso-motor nerves, and if they are cut off from the central nervous system the bloodvessels can no longer dilate or contract, but remain permanently dilated. The part supplied by these nerves will therefore always have a slow blood-stream, and will be cold and congested.

When a fracture of the spinal column occurs, the

upper part of the spine falls forward on the lower, and the soft spinal cord is nipped between the two fragments. As a consequence of this, impulses can no longer be sent down to the nerves which lie below the seat of injury, and the muscles cannot be moved—*i.e.*, they are paralyzed. Stimuli can no longer pass up the cord to the brain, and so there is complete loss of sensation in the parts supplied by the nerves below the seat of injury, and, as they are also cut off from their trophic centres in the brain, inflammation, ulceration, and sloughing will very easily occur in them. The nerves above the seat of fracture will be entirely unaltered, and their functions, both motor and sensory, remain normal.

Among the motor fibres will be those going to the bladder and rectum, and; these being interrupted, there will no longer be any power over the passage of the urine and fæces, micturition and defæcation being entirely beyond the control of the patient.

In some cases it will be seen that some weeks after a fracture has occurred the patient will draw up the legs when the feet are tickled, but this is quite an involuntary motion over which the patient has no control, and will take place without his consciousness.

To sum up : After a fracture of the spinal column in which the spinal cord has been damaged, there is complete paralysis of all the muscles supplied by the nerves below the seat of injury, the parts below the seat of fracture will be absolutely insensitive to pain or touch, and a slight cause may start acute inflammation in them which will be difficult to check.

Treatment of Fractured Spine.—In a case of fractured spine first aid consists in keeping the patient

absolutely still, lying on his back. In transplanting him from the place where the injury occurred to the place where he is to be treated, he should be laid on a firm, flat surface, such as a shutter or a hurdle, and in lifting him on to this care should be taken that all the assistants move together, so that no jar or wrench takes place. He should be covered up to counteract shock, and as soon as possible placed near a fire, where he should be left until the bed is ready in which he is to be nursed.

The patient should be clad in a single flannel garment opening all the way down the back, and reaching just below the middle of the thigh.

The bed should be similar to that used for fractures (see p. 206), and should have a fracture-board placed underneath the wire mattress. On it should be placed a water or an air bed. Air-beds are of great value where the amount of assistance is limited. They are light and easily moved and filled, and can be placed on any bed or on a couch. Water-beds are very heavy, and so cannot readily be shifted ; they are also somewhat cold, and are difficult to fill. They have the advantage of being more stable than the air-beds, and are generally preferred for hospital work.

The bed should be arranged as follows :

1. Water-bed.
2. Double thickness of blanket.
3. Long mackintosh.
4. Sheet.
5. Draw-mackintosh under the buttocks.
6. Draw-sheet over the draw-mackintosh.

Care should be taken that the water-bed is neither too full, so that the patient moves about, nor too empty, so that the benefit of the water is lost. The water should be

warm when it is put in, and if the patient complains of or feels cold, about once a week a bucket of the old water should be removed and a bucket of hot water added. A water-bed can be kept as long as three months without being refilled.

The double blanket and the long mackintosh are changed when necessary; the time will vary with the amount of incontinence, and whether diarrhœa be present or not.

The draw-mackintosh is changed when necessary, and in all cases a fresh one should be used once a week. Great care must be taken that the whole bed is kept perfectly smooth, and this particularly applies to the draw-sheet. This should be made of calico, and must be drawn quite tight and smooth, as a small wrinkle in the draw-sheet may be the cause of a bed-sore.

A small down pillow should be placed under the head; air-pillows are too tight to be really comfortable. When the bed is ready the patient is undressed. This must be done with great care, and all unnecessary movements of the patient avoided. The clothes should be cut away when necessary along the outside seam. The boots are removed without jerking, and the patient, while being undressed, rolled from side to side, and not lifted.

Four people are necessary to lift him on to the bed, one at the head, one at the lower extremities, and two at one side. He should be held as near to the seat of fracture as possible, and gently lifted on to the bed.

After a fractured spine death may occur from (*a*) shock; (*b*) asphyxia; (*c*) cystitis, etc.; (*d*) bed-sores.

Shock.—Directly the patient is in bed he should be wrapped in a warm blanket, and hot-water bottles

placed along his sides and at his feet. Each water-bottle should be covered with a flannel case or wrapped in a blanket, so that it does not touch the patient. As the skin is quite insensitive, a hot-water bottle can severely burn a patient without any complaint being made, and without the patient withdrawing the burnt limb from the bottle. If the shock is profound, stimulants are given, but they should be avoided if possible, as their use may increase the hæmorrhage taking place in the spinal cord, and so cause increase of the paralysis.

Asphyxia.—This will occur at once if the fracture be high in the neck, owing to paralysis of all the muscles of respiration, and neither the nurse nor the surgeon can render any assistance.

It may occur also a few days after the accident, owing to the onset of hypostatic pneumonia. The patient, whose respiratory muscles are partially paralyzed, is not able to breathe deeply or to cough. The lungs are never properly expanded, and the mucus cannot be expelled from the bronchi. The mucus gradually collects till the lungs are full, and the patient dies of slow asphyxia.

Cystitis.—This is inflammation of the bladder, and is due to the presence of micro-organisms introduced during catheterization. It is always due to want of asepsis.

Directly after the fracture has occurred the patient suffers from retention of urine, and the passing of a catheter is necessary to relieve him. This retention may recur during the first few weeks, requiring the constant use of a catheter. Later, as a rule, this

retention will give place to incontinence, which may be of two varieties:

1. The urine will constantly be flowing away from the bladder, and keep the patient always wet.
2. The bladder will automatically fill and empty about every six hours.

Incontinence can be met in men by arranging a urinal, but it is most necessary to keep the external genitals clean and dry.

Catheterization.—The catheter used for both male and female cases should be the soft indiarubber one known as Jaques, and No. 8 should be chosen. Before using it the nurse should thoroughly cleanse her hands as for an operation, and the catheter should be sterilized by boiling, and placed in very weak solution of carbolic (1 in 100).

The external genitals should then be washed with soap and water, and sponged with 1 in 5,000 perchloride of mercury with sterilized swabs, and the parts well exposed. The catheter is lubricated with sterilized oil, vaseline, or glycerine and perchloride of mercury (1 in 1,000), and is passed into the urinary meatus without touching the external genitals. After the urine has been drawn off and the catheter removed the parts are dried with gauze and powdered.

The catheter is at once cleaned and dried (see p. 264), and put away till required again.

The presence of cystitis will be shown by the finding of pus in the urine. Owing to the cutting off of the trophic nerves the cystitis is extremely likely to be uninfluenced by treatment, and the inflammation may spread up the ureters to the kidneys and cause death.

When cystitis is present, the nurse may have to wash out the bladder (see p. 266).

In cases of incontinence of urine in women it is impossible to arrange a satisfactory urinal to collect the urine, and the following plan must be adopted :

Incontinence of Urine in Women.—Bed.—Over the mattress there should be a long mackintosh, and this is covered with a sheet, and on this rests a water-pillow. Covering the water-pillow is a long mackintosh and a draw-sheet. It is better not to put any wood-wool or cotton-wool in the bed to absorb the urine, but to let it pass straight into the bed. The draw-sheet must be changed as often as necessary—sometimes every hour or two—and each time the sheet is changed the mackintosh should be wiped well with 1 in 20 carbolic lotion, and then dried. This will prevent decomposition of urine and smell.

The patient's back, buttocks, genitals, etc., should be washed each time the bed is changed with warm soap and water, plenty of soap being used, and then dried very thoroughly.

A little benzoin and zinc ointment is then rubbed thoroughly into the back, so as to just have it greasy, and it is then thoroughly covered with starch and boracic powder.

The patient and the bed must be left absolutely dry after each change, and if properly nursed there should be no smell.

The long mackintosh covering the mattress should be changed two or three times a week.

Prevention of Bed-sores.—The care of the back is begun immediately the patient is put into bed, and the first essential is that the bed should be kept clean,

dry, and free from all crumbs and wrinkles in the bedding.

The back of the patient should be washed with warm soap and water three times a day, using plenty of soap, and rubbing with a brisk circular movement. A little soap should be left on when wiping, and the back then rubbed with methylated or other spirit—whisky, eau de Cologne, etc.—for two minutes. After this it is thickly dusted with zinc oxide and starch or some other form of dusting-powder.

In addition to this routine treatment of washing and rubbing three times a day, the same process should be gone through every time the patient is moved, either to change the sheet or to remove a bed-pan.

The bed-pan should be warmed, and the edges smeared with a little oil, so that it does not stick to and tear the skin in removing it.

Great care should be taken that the patient is lifted off the bed-pan before it is removed, or the skin may be uncomfortably pulled even if it be not torn.

The back must be carefully watched for signs of pressure, which will be shown by discoloration of the skin, and the part pressed upon may be relieved by a careful adjustment of small pads, cushions, or rings made of padding wool covered with mackintosh. These, if used, will need constant watching, as they are apt to shift and increase instead of diminishing the danger.

When the first sign of a bed-sore appears it must be at once reported to the surgeon.

The arms should be kept away from the sides, and the legs kept apart by long, narrow pads or pieces of cotton-wool.

Pressure should be kept off the heels by adjusting

heel-pads in the hollows just above the heel, and the pressure of the bed-clothes must be kept off the toes by means of a cradle. The feet should rest against a pillow, so that they are kept at right angles to the body. After washing all the parts exposed to pressure, they should be rubbed with spirit and thickly powdered with zinc oxide and starch.

Special care should be taken to keep the cracks and folds of the skin—*i.e.*, the groins and axillæ—dry and well powdered, and, as the pillow is small, it must be seen that the ears are not folded over, or troublesome cracks may occur behind them.

In changing the draw-sheet in cases of fractured spine at least three people are necessary, one at the patient's shoulders and one at the lower extremities to turn the patient, whilst the third draws the sheet through. The patient should be rolled, not lifted, and in rolling it is important that both nurses move together.

Bed-sores.—In some cases these will occur in spite of the utmost care. This is due to interference with the trophic nerves, as described at the commencement of this chapter; but in the majority of cases they can be avoided by careful nursing.

If the skin is broken over any part, and a 'bed-sore' is present, the rubbing with spirit should be stopped, but the part round the sore should still be well washed with soap and water, and dried carefully. The sore and the surrounding skin are smeared with zinc ointment, and then powdered with oxide of zinc and starch-powder, care being taken not to leave an excess of ointment. The surrounding parts should still be rubbed with methylated spirit.

If a slough form, fomentations of weak lysol (♏xx to Oi) are used till it separates, and the granulating surface is then dressed with pieces of lint cut to its exact size and soaked in red lotion or equal parts of Friar's balsam and castor-oil.

Pressure on the sore must be relieved as much as possible by shifting the patient's position from time to time, or placing a collar of cotton-wool or amadou plaster round the ulcer, so that it lies in the centre of a cup.

In some cases of fractured spine the surgeon may decide to do the operation of laminectomy. This operation is also done for other complaints, such as tumour or tuberculosis of the vertebræ.

After fracture the operation may be done as soon as shock has passed off, or it may be postponed for weeks or even months after the accident; but the procedure will be the same in all cases.

After an operation of laminectomy the patient must be treated in exactly the same way as a fractured spine, as the surgeon has removed part of the bony rings of several vertebræ, and the same dangers and complications are to be feared.

When a fractured spine has firmly united, the patient can often get about in a spinal chair, although the lower limbs will be completely paralyzed. Owing to the alteration in the bloodvessels, chilblains are particularly liable to occur in the cold weather, and they must be guarded against by warmly clothing the patient.

Of course, after three months the spinal column will have healed, like any other bone, and the necessity for great care in moving will not be present, but the same liability to bed-sores will remain.

CHAPTER XVI

NURSING OF HEAD INJURIES

General considerations—Concussion—Treatment—Cerebral compression—Cerebral irritation—Treatment—Fits—After-treatment of head operations—Traumatic delirium—Delirium tremens—Treatment.

The brain, surrounded by its membranes—the dura mater, arachnoid, and the vascular pia mater—is enclosed in an unyielding box—the skull. Any blow to the skull is transmitted to the brain, and the effects on the delicate structures of the nervous system may be severe without there being any external marks of violence. After any head injury the patient will suffer from a set of symptoms known as *Concussion* of the brain, which may last from a few moments to days. These symptoms may end in complete recovery, or the patient may pass into a condition of mental enfeeblement. If the injury is severe enough to rupture a large bloodvessel the effused blood will cause *Compression* of the brain in its bony vault, and the symptoms of cerebral compression will supervene on those of concussion. If the brain be bruised or lacerated a train of symptoms known as *Cerebral Irritation* will be present. After any head injury, therefore, a patient may suffer from concussion, compression, or cerebral irritation, and a patient at first showing the symptoms

of concussion may pass into the condition of compression, and it is important that the change should be recognised at once, otherwise the favourable time for operation will pass.

Concussion.—With a patient who is in a condition of concussion there will be the history of an accident, and perhaps a scalp-wound or bruise on the head. The patient will lie extended, and appear unconscious, but he can usually be roused by shouting or shaking. The pulse will be weak and fluttering, the respiration shallow, the pupils equal, the temperature subnormal, and the patient's face bathed in a cold, clammy sweat. This is the stage of shock.

After a variable time the patient will turn over on one side, draw the legs up, and vomit. The vomiting is a good sign, and introduces the stage of reaction. The temperature rises till it is above normal, the pulse becomes full and bounding, the respiration deepens, the face becomes flushed, and the patient has a splitting headache. His temper is irritable, and there is dislike for all noise, bright light, and conversation.

This stage will last for a day or two, and then will be followed by the stage of convalescence. During this stage the patient will be irritable, his memory for recent events bad or lost, headache will be severe, and there will be an impossibility of concentrating the mind. Fits may occur, and there may be alteration in the special senses of hearing and seeing. Gradually the patient will recover, or one or all these symptoms may remain as a permanent condition.

Treatment.—The patient should be at once undressed, wrapped in a warm blanket, and put to bed with hot-water bottles at the feet and sides.

The head should be kept low without a pillow, and if there be a scalp wound, the hair round it should be cut close with scissors, and an aseptic pad and bandage applied, as in other wounds (see p. 44). The head of the bed should be covered with a mackintosh. Although the condition is one of shock, stimulants must not be given unless the patient is actually in danger of dying, for the action of the stimulant may be carried over to the stage of reaction, and will do harm by increasing the force of the heart's beat.

During this stage the surgeon will probably treat the scalp wound by shaving the head round the wound, cleaning and stitching it up.

If this stage lasts more than a few hours the bladder must be attended to, unless the patient passes urine unconsciously. Any urine that is drawn off by catheter must be carefully saved to be tested for sugar and albumen, as it is often difficult to diagnose between cerebral concussion and coma due to diabetes or Bright's disease. Should this condition last for days, nasal feeding will be necessary, and as the patient is unconscious, the nurse must be absolutely certain that the tube is in the œsophagus before the milk is poured into the funnel, as it is easy in an unconscious patient to pass the tube into the larynx (see p. 174).

The bowels should be opened by enemata unless a purge is ordered.

Directly it is seen that the stage of reaction is commencing it is customary to give a brisk purge either of calomel or croton-oil (♏ i to ♏ ii). If calomel be ordered, the mouth can be opened by introducing a spatula, and the powder, mixed with a little butter, placed well on to the back of the tongue, when it will be swallowed involuntarily. To give croton-oil a ball is made of a

small piece of butter, and the oil put on it; the mouth is opened with the spatula between the patient's teeth, and the butter placed on the soft palate or at the back of the tongue.

The vomit that ushers in the stage of reaction should be saved, as it is often important for medico-legal purposes to know if alcohol be present.

During the stage of reaction the patient should be kept quiet and in a cool, darkened room. All noise and conversation should be avoided, and the friends should be kept away. If ordered, the head must be shaved, and cold applied in the form of an ice-bag or Leiter's tubes, and it is most important to keep the cold applied constantly, as an intermittent application is harmful. The diet should be light and non-stimulating, beef-tea, broths, and meat extracts being avoided. The bowels should be kept well open.

The irritability of the patient must be met with tact on the part of the nurse, and the patient must be as far as possible shielded from all mental activity and worry.

Any attempts at reading or work must be discouraged for the first few days, and the more rest the patient takes the less likely are unpleasant sequelæ to occur.

Cerebral Compression.—A patient suffering from concussion may pass into the condition of compression without regaining consciousness, or there may be a brief interval during which the patient will be apparently recovered, and may insist on getting up, and, if in hospital, on going home. In a few hours, however, the symptoms of compression will come on. When the brain is compressed by blood the patient will show the following symptoms: the face is flushed,

warm, and sweating; the pulse is full and bounding; and the respiration is stertorous—*i.e.*, a peculiar noise is made during expiration, owing to the flapping of the paralyzed soft palate.

Loss of consciousness becomes more and more marked till it is complete, and the pupils are usually unequal, though in the later stages they are both widely dilated, and do not react to light.

There are frequently spasmodic movements, or rigidity of the limbs on one side of the body, and either of these should be carefully noted for the surgeon's information, as it points to a lesion on the opposite side of the brain to which the rigidity is.

The temperature is usually raised, and should be taken on both sides of the body, for it will frequently be found to differ on the two sides. A note should be made of whether the patient has passed urine and fæces.

In nursing a case of head injury it is important to be early aware of the change of symptoms from concussion to compression, and if symptoms of compression be found the surgeon should at once be sent for. Cerebral compression after a head injury always demands immediate surgical treatment. Whilst preparations are being made for this, the patient must be kept on his back in bed without a pillow. An india-rubber ring or piece of cork should be kept at hand to place between the patient's teeth should fits occur, so that the tongue is not bitten.

In these cases the preparation of the patient will usually take place on the operating-table, but if it is left to the nurse to do beforehand the whole of the head should be shaved, and other usual preparations of the skin done. With the patient unconscious, there is

usually no need to give an anæsthetic, but the usual preparations for one should always be made.

After the operation, which will be that of trephining —the removal of a piece of bone from the skull—the patient must be kept flat in bed, and the case nursed like one of cerebral concussion, all noise, light, and stimulants being avoided. The diet should be light, and if the unconsciousness continue after the operation nasal feeding will be necessary.

As the brain is the seat of the mind and intelligence, it is to be expected, after a severe injury to the skull, and consequent damage to the brain, that mental disturbance will be common. This is found to be so, and very frequently after the concussion has passed off the patient remains in a state of *cerebral irritation.* In these cases there is usually laceration of the brain.

Cerebral Irritation.—The patient suffering from this condition lies curled up in bed, and resists any attempt to straighten him. His head is buried in the clothes, and he dislikes bright light and loud noises. He resents all interference, and if disturbed will curse and swear. Food will often be taken if it be left by him, but attempts at feeding are resisted, and the food pushed away.

The patient usually wilfully passes his urine and fæces under him, but will sometimes use a urine-bottle if it be put near him and left.

The temperature, which is taken with difficulty, is often subnormal.

This state of irritability lasts varying times, fourteen days being an average, and the patient gradually becomes more sensible, and has a vague and hazy idea

of what has happened. He will sometimes apologize for the trouble he has given.

In other cases the condition may pass on to insanity, though traumatism is by no means a common cause for loss of mental equilibrium.

Treatment.—The most successful form of treatment is the avoidance of all active measures. Absolute rest and quiet is the key-note, and it is the nurse's part to see that this is carried out. No conversation, bright light, or noises should be allowed in the patient's room. His bed should be touched as little as possible. There is no need to keep it straight. No attempts should be made to rouse him or to ascertain if he is conscious.

Coal should be put on with the hand, and the fire stirred with a stick. Flickering lights especially are to be avoided.

If he will take food placed by him, let him do so, but it is necessary that he should take sufficient and at frequent intervals. The food should be fluid—milk and beef-tea — but if the patient absolutely refuses to take it, it must be administered by the nasal tube.

All nursing details must be carried out quickly and quietly, and in the intervals the patient be left absolutely alone. If retention of urine be present, it must be relieved by the catheter, but this is seldom required. After all head injuries the nurse must be prepared for outbursts of excitement on the part of the patient, and attempts to get out of bed and escape from the room.

It is exceedingly rare for the patient actually to attempt to injure himself or another, but he may do

either in trying to escape from what he considers confinement.

For the treatment of acute mania, see p. 241.

Fits—*i.e.*, traumatic, or Jacksonian epilepsy—may occur after head injury, and the nurse should be careful to note the following points :

1. In which part of the body the fit started.
2. In what manner the fit started.
3. In what direction the eyes were turned.
4. Did the patient lose consciousness.
5. Did he bite his tongue, or pass urine or fæces, while in the fit.

During the fit the nurse should take care that the patient does not injure himself or jerk himself out of bed. An indiarubber ring should be placed between the teeth to prevent him biting his tongue.

After-treatment of Cerebral Operations.—The after-treatment of operations upon the brain follows the ordinary rules of aseptic surgery.

The patient is kept lying in bed with a small, hard pillow under the head. The diet should at first consist chiefly of milk, but no special directions are necessary for the feeding of these patients.

One point is to be noted in dressing cases of operation on the brain, and that is that great care should be taken in removing any drainage-tubes, as it will be exceedingly difficult to replace them.

Traumatic Delirium.—This is a term that is applied to a delirious state that sometimes supervenes after injuries and surgical operations. It may depend upon :

1. Sepsis.

2. A weak condition of the nervous system, either inherited or acquired by overwork or mental strain.

The septic variety usually occurs from the third to the fifth day after operation or injury, when the absorption of toxins is at its height. It is usually worse at night, when the temperature is raised, and abates with the morning fall. The patient is, as a rule, restless, constantly talking and crying out, has flushed cheeks and a dry tongue.

These symptoms, as the patient gets worse, change into a condition known as the 'typhoid state,' in which there is a low muttering delirium, dry tongue, sordes on the lips and teeth, a tendency to sink down into the bed, and often picking at the bed-clothes.

The first part of the treatment is to remove the septic material by free incisions or opening up of the wound, and drainage.

Stimulants are, as a rule, necessary, and often injections of antitoxin are ordered.

The patient should be nursed on a water-bed, as the restlessness and the septic conditions both lead to bed-sores, unless great care is taken.

Although the patient is delirious, he will often do what he is told, and the nurse should always try and soothe him by talking to him and quietly restraining him by word and touch when he tries to get up. If this is not sufficient, the blanket covering him should be stretched across his chest with the arms underneath, and then pinned down to the mattress, or it may be necessary to put on shackles, which are to be preferred to wrestling with the patient, violence in holding him usually making him more excited.

It must be seen that the shackles are carefully padded

or the wrists and ankles protected with a strip of gamgee tissue.

Incontinence of urine and fæces is frequently present, and the patient must be cleaned directly one or the other is passed, and the back must be attended to each time, as in other cases of incontinence (see p. 229).

Care should be taken that the patient does not remove his dressing, and he must be constantly watched to prevent him from injuring himself or getting out of bed.

A nurse should never leave a delirious patient alone.

Patients in delirium will often refuse to take food and medicine, especially the latter, affirming that they are being poisoned. By firmly insisting, these patients can often be made to swallow, but if they obstinately refuse the nurse should abandon the attempt until she can obtain assistance.

Medicine and food, in cases of refusal, should be given by the nasal tube, but the assistance must be sufficient to render the patient quite helpless, otherwise the struggling will exhaust him, and do him more harm than the medicine does good.

The drugs commonly given for delirium of the active type are paraldehyde, chloral, bromide and opium; but in the low muttering type it is more important to employ stimulants. The danger of the hypnotic drugs (sleep producers) is their depressing effect upon the heart.

Nervous Traumatic Delirium.—This complication, which is rare, may occur in people of susceptible nervous temperament, or people exhausted with brain work. The delirium is usually of the low

muttering type, but occasionally it may be maniacal. It is this form that is the brain fever of the novelist.

The treatment is absolute quiet, and the use of hypnotics, with most careful feeding. Some authorities believe in overfeeding in these cases, giving large quantities of soft food, particularly milk and eggs, if necessary by the nasal tube.

There is nothing further to add to the nursing of this form of traumatic delirium to that already given for the septic type.

Delirium Tremens.—This is a form of insanity always due to the excessive use of alcohol. It occurs in patients who have systematically drunk to excess for years, and who show signs of chronic alcoholism; but occasionally it has been seen in children whose parents are alcoholic, and who have been given alcohol in early life.

The exciting cause of the attack is either an accident, such as a fracture, an operation, or an acute illness, such as pneumonia, and it is denied that the sudden stoppage of alcohol plays any causative part in the production of the disease.

The attack manifests itself soon after the accident or operation, as a rule starting in forty-eight hours. It is first noticed that the patient is restless, constipated, and has a thick fur on the tongue. There is sleeplessness and distaste for solid food, though the patient will often drink large quantities of fluid. If the patient be told to hold the tongue out, it trembles, and the arms shake when held up. The pulse is increased in frequency, and the temperature is often raised (100° F.). These are the prodromal (warning) symptoms, and show that an attack is imminent.

The chief symptoms of an attack are :

Hallucinations, usually of sight, the patient complaining of rats, mice, snakes, etc., crawling about him ; but they may be of hearing, and the patient complain of people abusing him. There are also bursts of maniacal excitement, during which the patient tries to escape from his imaginary adversaries, the delusions generally frightening the patient.

There is an utter disregard of pain, and the presence of a fractured femur will not prevent the patient trying to walk.

As the delirium continues, the pulse gets more and more rapid and feeble, there is rapid loss of strength and flesh, and the sleeplessness continues. If the disease is not checked, death takes place from heart failure.

The prognosis is usually favourable, but in some cases the delirium passes into melancholia, dementia, or other forms of chronic insanity, or, as mentioned above, death may occur in a few days.

Treatment.—After every fracture, in people addicted to alcohol, the nurse should carefully watch for the prodromal symptoms of sleeplessness and tremor, and at once report them to the surgeon, as prompt treatment may avert the attack.

The first step in the treatment is the administration of a brisk purgative. The patient should be kept absolutely quiet in a room by himself, and no visitors allowed to see him.

Solid food should not be given, as the patient will be unable to digest it, and there is often an absolute disgust for it ; but every effort should be made to induce the patient to take a large quantity of good

liquid nourishment, as successful feeding is the key-note of successful treatment of these cases.

It is perhaps best to avoid hypnotics entirely if the patient can be secluded, and to trust to careful feeding, quiet, and warm sponging to induce sleep ; but where constant skilled attendance cannot be obtained, or in hospital, where other patients have to be considered, chloral, bromides, or morphia must be given in suitable doses, but there is danger in their use, as they all cause cardiac depression.

Alcohol or other stimulant should be given if the heart show signs of failing, and it is most important to keep a careful record of the pulse-rate, as sudden collapse may occur. Some surgeons give alcohol in the form of stout early in the case as a hypnotic, but the benefit is doubtful.

If violent, the patient is secured by shackles, and not by manual force, and this being done efficiently, the nurse or attendant should keep out of sight as much as possible whilst watching him, and not irritate him by smoothing the bed-clothes, etc. Should the injury be a fracture, the limb must be fixed firmly between well-padded splints and slung in a cradle, and at the same time the patient secured in bed, so that he cannot touch the apparatus or get up. There is less likelihood of harm if the patient and the fracture be secured in this way than if the limb be fixed to the bed with sand-bags and a fracture-cloth. Incontinence of urine and fæces will often be present, and the usual treatment for this must be adopted, and the back well looked after to prevent bed-sores.

CHAPTER XVII

NURSING OF RECTAL CASES

General considerations—Preparation for operation—Retention of Urine—Hæmorrhage—Purgatives—Dressings—Fistula in ano—Prolapse of rectum—Incontinence of fæces—Rectal examination.

THE rectum is the last five inches of the alimentary canal, and ends at the anal orifice. It is subject to certain diseases which are peculiar to it, such as hæmorrhoids or piles, fistula, and fissure, as well as being the seat of those diseases found in other parts of the body, such as cancer and ulceration.

So important and numerous are diseased conditions of the rectum that special hospitals exist solely for the treatment of them, and there are surgeons who make a study of them their speciality.

There are two facts about the rectum that must be always borne in mind in its surgery, in which it differs from other parts of the body :

1. It is impossible to render it aseptic.
2. It is only to a slight degree possible to control its function, and some modification of ordinary surgical technique is necessary in the treatment of rectal cases.

Preparation of a Patient for a Rectal or Anal Operation.—The patient should be kept lying down in bed for twenty-four hours before the operation, so as to relieve any congestion of the parts and diminish

the amount of hæmorrhage that will occur. The skin round the anus should be shaved if necessary, and the ordinary cleaning with soap and water and biniodide of mercury should be carried out, but it is quite useless to put on a compress.

The alimentary canal should be well emptied before the operation, so that the bowels will be confined for a day or two after, and so the wound will not be soiled by the passage of fæces. This is done by giving a purge two nights before the operation, and repeating it the night before.

The rectum itself must be well cleaned by giving two large soap-and-water enemas. If the operation is going to take place in the afternoon, one enema should be given about five o'clock in the morning, and the other at eleven o'clock.

Should the purges not have acted well and the patient be constipated, or if it has not been possible to give a purge, three enemas should be given. After the last enema has acted the part must be well washed.

The dressing in a rectal case is usually secured by a T bandage. This is best made out of a calico rib-roller, as a domette or linen bandage is too narrow and soon gets rolled up into a cord which is liable to cut the patient.

It should be secured round the patient's waist before the anæsthetic is administered, as this will save much moving of the patient. It is better to bring both tails up on one side of the external genitals, as the bandage can then be more tightly fastened without discomfort to the patient than if it be brought up on both sides in the usual way.

A morphia suppository ($\frac{1}{2}$ grain) should be ready in

case the surgeon desires to put one in the rectum after operation.

It is sometimes advantageous to tie the knees of the patient together after he is put back into bed, especially if there has been much stitching done in the perineum.

After the operation, two complications are especially liable to arise :

1. Retention of urine.
2. Hæmorrhage.

Retention of urine is common after operation on the rectum, and is a reflex action, the pain in the rectum preventing the action of the bladder muscles, although the patient feels the desire to pass water. It should always be watched for, and if urine be not passed for twelve or fourteen hours, or if the patient desires to pass urine and cannot, hot fomentations should be applied, or the external genitals bathed with warm water.

Should these methods not have the desired effect, the catheter must be used with the usual precautions (see p. 228).

Hæmorrhage is not uncommon after rectal operations, owing to the large veins found in the parts and the impossibility of applying efficient pressure by the bandage.

Bleeding will often take place into the rectum, and will be retained by the sphincter muscle guarding the anal orifice, so that a large amount of hæmorrhage may occur without any of it showing externally and without the patient being conscious of it. It is therefore important to watch a rectal case closely for the signs of internal hæmorrhage (see p. 78), and not to trust entirely to inspection of the dressing. It not infre-

quently happens that a patient will get restless and blanched with no blood appearing ; a desire to pass a motion is felt, and a large quantity (1 or 2 pints) of clotted blood comes away.

Should a patient after a rectal operation show the signs of concealed hæmorrhage, the surgeon must be at once sent for, and whilst waiting for his arrival it is as well to prepare the things for a further anæsthetic and operation, as well as those for the arrest of hæmorrhage and the combating of its effects.

Purgatives.—It is usual to keep the bowels confined for two or three days after a rectal operation, and for this purpose various drugs, especially opium and catechu, may be ordered. To secure the same end, it it important that the diet should not be stimulating to the alimentary canal, and beef-tea, meat, and green vegetables should not be given to the patient.

To get the bowels open, a purge is usually given on the third evening after the operation, and after that aperients are given in the usual way to secure a daily action of the bowels.

After the bowels have been opened, the thing of greatest importance is to keep the patient absolutely clean. Each time a motion is passed the part must be carefully washed with a weak antiseptic solution (*e.g.*, carbolic lotion 1 in 80), and a fresh dressing applied.

Dressing of a Fistula.—If the case be one of fistula in ano the nurse will be required to replace the gauze in the wound each time the bowels are opened. The part is cleaned, and a fresh strip of gauze is laid right at the bottom of the wound and passing into the rectum. If every part of the fistulous track is not filled with gauze premature union will occur and a second

operation be necessary, the dressing being almost of equal importance with the operation itself to effect a cure. After the gauze has been inserted a clean dressing is applied and secured by a T bandage. Rectal cases should be kept lying down in bed, as the sitting posture tends to open the wound and prevent healing; but after the bowels are opened, and if the patient be well enough, a daily warm bath, followed by the dressing, is a great aid to cleanliness.

Prolapse of the Rectum.—This is the projection of the lower end of the rectum through the anal orifice, and is most commonly seen in young children, although it may occur in adults. It is due to some irregularity of the bowels, either diarrhœa or constipation, or to the presence of a polypus in the rectum. Should it occur during the nursing of a case, the bowel should be returned at once, and the fact reported to the surgeon at his next visit. The prolapse is replaced by pressing firmly on it with a piece of lint smeared with vaseline or oil. There is usually no difficulty in replacing it. After it has once occurred the child should be made to pass its motions lying down and not in the usual position, and in this way a permanent cure can be brought about even in old-standing cases.

Incontinence of Fæces.—This is usually secondary to some disease or injury of the nervous system, such as crushing of the cord in fractured spine, and is associated with incontinence of urine. But it may occur as a symptom of disease of the rectum, or follow some surgical interference with the part.

It is one of the most distressing complaints from which a patient can suffer, and from the nurse's point

of view brings with it a greatly increased risk of bed-sores.

The nursing of cases of incontinence of fæces is fully described in the chapter on fractured spine, but in this place it is desired to call attention to a special form of incontinence associated either with diseases of the rectum and anus, or with general constipation, and which is known as *false incontinence*, or *impaction of fæces*. If a patient has some obstruction to the passage of his motions from the rectum, or is very constipated, the fæces collect in the rectum and lower part of the alimentary canal. The fluid part is absorbed, and the result is the formation of a hard, large mass in the rectum which effectually blocks the passage. This may cause the symptoms of intestinal obstruction, but frequently the phenomena of false incontinence is seen first.

The hard, scybalous mass in the rectum causes inflammation of the rectal mucous membrane, and an increased secretion takes place which trickles down mixed with a little fæces. The mass in the rectum interferes with the action of the sphincter muscle, and prevents it from retaining liquid fæces, and the patient apparently suffers from incontinence. It is important to recognise this condition early, otherwise the chart may show a degree of diarrhœa in a patient who is really constipated (see p. 149). The diagnosis is made by rectal examination, when the hard mass of fæces is easily felt. The treatment of these cases is usually started by the giving of enemas, either the plain soap and water or an olive-oil enema (see Appendix) ; but in severe cases the mass is too hard and too large to be moved by this method. The only thing to be done is to remove the mass piecemeal with the fingers, or with

the aid of the handle of a teaspoon, and after this is done to continue with enemata and purges.

Rectal Examination.—Should the surgeon desire to make a rectal examination, the patient should be placed lying on the left side with the knees well drawn up, and the buttocks slightly projecting over the side of the bed. The night-dress is pulled up, and the patient only covered with the sheet. The bed should be arranged so that there is a good light on the part, as inspection is frequently one of the most important methods of investigation of disease of the rectum. The following things should be got ready :

1. A receiver.
2. Two or three swabs.
3. A piece of soap for filling the nail.
4. Vaseline.
5. An indiarubber finger-stall, if obtainable.

A bowl of lotion with swabs should be at hand in case the anus requires washing, and if the surgeon is not bringing his own instruments, a rectal speculum, a probe, some cotton-wool, and an artificial light should be ready, the instruments, of course, being sterilized. After the examination, soap and water, a nail-brush, and a clean towel should be in readiness.

CHAPTER XVIII

URINARY CASES

Urine—Quantity—Retention—Suppression—Incontinence—Retention with overflow—Tests for sugar—Albumen—Uric acid—Phosphates — Specific gravity — Kidney operation — Bladder operation—Care of catheters—Washing out bladder.

The urine is secreted by the kidneys from the blood, and consists of the waste products of the body diluted with water.

The urine passes down the ureters into the bladder, and then passes out of the body by the urethra.

Any disease occurring in the urinary tract from the kidney to the exterior will alter the urine either in quantity or constituents, and it is therefore important to know some facts about the normal composition of urine, the amount that should be passed in health, and the frequency with which it is usually voided.

Quantity.—A healthy male adult passes 50 ounces of urine in twenty-four hours, a woman a few ounces less. More urine is secreted during the day than at night.

Children secrete comparatively little urine. An infant secretes 4 to 6 ounces daily, at six years a child passes 12 ounces daily, and at twelve 20 ounces.

In dying patients the amount secreted is very small,

and this diminution in urine is often an important prognostic point in death from heart failure.

The colour of the urine is a pale amber ; it is usually acid (*i.e.*, a piece of blue litmus-paper dipped into it becomes red) ; but if the patient is on a diet without meat it may be alkaline (red litmus-paper becomes blue), especially after a meal.

It contains no sugar and no albumen, and has a specific gravity of 1015 to 1025. On standing, there is no deposit, but a cloud of mucus usually becomes apparent floating in the middle of the urine.

How to Save and Measure Urine.—The amount of urine passed during the day should be separately measured from that passed during the night, and the sum of the two gives the total for twenty-four hours. If specially ordered, the bladder should be emptied at a fixed hour—say, six o'clock—and all the urine passed during the day carefully saved. At 6 p.m. the bladder is again emptied, and added to the day's urine. The urine passed during the night is then collected, and at 6 a.m. again the bladder is emptied, and so the night urine is obtained. In children and women it is particularly difficult to collect the urine, and if great accuracy is required it must be drawn off by catheter.

To Collect a Specimen from a Child too Young to understand what is Wanted.—If a boy, the child must be secured with shoulder-straps and the legs fastened down. A funnel made of pink mackintosh is wrapped round the penis, and the end passed into a receiver secured between the child's legs. If a girl, the child must be placed on a bed-pan, and kept there till urine is passed.

The simplest way, of course, is to obtain a catheter specimen.

After the day and the night urines have been collected and measured, a mixed specimen of the twenty-four hours' urine should be placed in a clean conical glass, covered with a glass plate or a filter-paper, and allowed to stand for a few hours in a cool place.

If there is not time to collect a twenty-four hours' specimen, one passed about three hours after a meal should be selected. If during the nursing of any case it is noticed that the urine does not appear normal, and especially if blood be noticed in it, the specimen should be saved and the fact reported to the surgeon.

Besides this, the nurse should also note the condition of the mechanism of passing urine, and there are four conditions which she should be able to recognise :

1. Retention of urine.
2. Suppression of urine.
3. Incontinence of urine.
4. Retention with overflow.

1. **Retention of Urine.**—This is usually strongly brought to the notice of the nurse by the pain the patient suffers, but in unconscious or dying patients the bladder may become distended and the patient give no sign. Retention of urine may occur after operations, especially rectal operations, and in any case, if the patient does not pass urine in sixteen hours or complains of pain, the surgeon should be told.

In cases occurring after operation, if the urine is not passed and the patient has pain, warm sponging or hot fomentations to the perineum may be followed by the flow of urine ; or, if the case does not demand the

dorsal position, the patient may be able to pass urine lying on his side.

If the condition does not yield to these simple remedies, the catheter must be passed, but it is better to wait for the surgeon's orders to do this. If, however, the pain is urgent, the nurse should pass a catheter on her own responsibility, for over-distension of the bladder may lead to permanent paralysis. (For rules of passing catheter, see p. 228.)

2. **Suppression of Urine.**—This means that no urine is secreted by the kidney and the bladder remains empty. It is one of the most dangerous complications that occurs after operation on the urinary passages, and if the secretion is not quickly established death is certain. It will also occur after the specific fevers, especially diphtheria. This complication can be diagnosed by the fact that, although the patient passes no urine, he suffers no pain or discomfort. The treatment consists of giving hot baths and various drugs for stimulating the action of the kidneys.

3. **Incontinence of Urine.**—This may be one of two varieties:

(1) The patient has constant dribbling of urine, and the bladder is always empty.

(2) Every four to six hours the bladder is emptied involuntarily, and in some cases, such as fractured spine, without the knowledge of the patient. In this case it is necessary to arrange some form of urinal, so that the patient is kept dry.

4. **Retention with Overflow.**—If the bladder becomes over-distended with urine, the muscle guarding the orifice of the urethra (sphincter urethræ) may

become incompetent, and the urine will continually dribble whilst the bladder remains full. It is important not to mistake this condition for true incontinence, and the diagnosis is made from the fact that the patient suffers from the pain and discomfort of retention, although incontinence is present.

As incontinence of this variety denotes over-distension of the bladder, if it come on after an operation and the surgeon is not easily available the nurse should empty the bladder with the catheter, to prevent subsequent paralysis.

Besides the mechanism of micturition, the quantity of urine passed should always be noted, and any marked diversion from the normal reported.

Before all operations the urine should be tested within twenty-four hours of the time of operating, for, if one of two abnormal constituents is present, many operations are contra-indicated. These abnormal substances are sugar and albumen.

Sugar occurs in the urine in several diseases, the most important of which are diabetes and glycosuria.

Diabetes is a disease most commonly seen in young adults, and the chief symptoms are the passing of a large amount of pale urine of high specific gravity, and great thirst ; on testing, sugar will be found in the urine in great quantity.

In a patient suffering from this disease all operations are contra-indicated except those absolutely necessary to save life, for should micro-organisms gain access to the wound there is great danger of the patient dying of septicæmia, as a diabetic has little resistance against the action of bacteria. The shock of the operation may also bring on fatal diabetic coma.

Glycosuria is a disease imperfectly understood,

occurring in elderly people who are as a rule fat and suffer from gout. The urine is a little increased in amount, and there is sugar present in small quantities.

These patients stand operations badly, but with careful dieting the sugar may often be caused to disappear, and then the operation can be done.

Patients with either diabetes or glycosuria are liable to suffer from boils and carbuncles, and in these complaints the urine should always be tested to ascertain the presence or absence of sugar.

Tests for Sugar.—1. Put some Fehling's solution in a test-tube and boil. If it remain clear, it is ready for use ; if a slight precipitate occurs, add some caustic soda till it dissolves.

To the Fehling's add a small quantity of the urine to be tested, and boil. If sugar be present, a yellow or red precipitate will appear.

If albumen be present, the urine must first be boiled, and then filtered before the test is carried out.

2. To some urine in a test-tube add a little picric acid in solution and a few drops of caustic soda. Boil. If sugar be present, the solution becomes a dark-red colour.

Albumen.—This is found in the urine in many diseases, but especially in inflammation of the kidneys. Operations are contra-indicated in cases of albuminuria unless they are necessary to save life, as these patients, like diabetics, are very liable to the attacks of micro-organisms, and should suppuration occur, it is very difficult to check.

Tests for Albumen.—It is absolutely essential that the urine should be quite clear, and if it is turbid,

it must be carefully filtered. This clear urine is then tested with red litmus-paper, and if it turns blue—showing that the urine is alkaline—a few drops of acetic acid must be added to acidulate it.

1. The urine is placed in a test-tube, and the upper part boiled; if it remains clear, no albumen is present; if it becomes cloudy, a little more acetic acid is added; and if the cloudiness remains, albumen is present.

2. Place $\frac{1}{2}$ inch of pure nitric acid in a test-tube and allow some of the clear urine to flow on to its surface from a pipette. If after standing for half a minute an opaque white ring appears at the junction of the two fluids, albumen is present. For exceptions and further tests, the reader is referred to a text-book on urine testing.

In noting the colour of the urine the nurse should specially be on the look-out for the dusky-green, smoky appearance of **carboluria**—*i.e.*, the presence of carbolic acid in the urine. This will occur when carbolic acid is being too freely used in the treatment of a wound, and is an early indication of carbolic acid poisoning. It can be tested for by adding ferric chloride (perchloride of iron) to the urine, when a rich crimson colour results; but it must be noted that the same colour and reaction are present if the patient is taking salol or salicylic acid as a medicine.

Blood occurs in the urine under various conditions, and in large or small quantities. If the urine contains only a small amount of blood it has a peculiar opaque appearance, to which the terms 'smoky' or 'porter-coloured' is applied. In large quantities the blood gives the urine a red appearance, varying in density with the amount of blood passed. The blood cor-

puscles usually settle to the bottom of the glass, producing a flocculent deposit.

Tests for Blood.—1. Place some urine in a test-tube, and add caustic soda. Boil. A brownish-red deposit in a bottle-green liquid indicates blood. This test is useless if the patient is taking senna, rhubarb, or santonin.

2. To some urine in a test-tube add 2 drops of ammoniated tincture of guaiacum ; a white precipitate forms. Add some ozonic ether without shaking. If blood be present a blue colour appears at the junction of the two fluids.

If the patient is taking iodides the test is fallacious.

3. Examine the urine under the microscope ; the characteristic red blood corpuscles are seen.

Pus appears in the urine if suppuration is taking place anywhere in the urinary tract, and this always is due to the presence of micro-organisms. But it will also occur if an abscess bursts into the bladder or into the pelvis of the kidney.

Tests for Pus.—1. The same test as for blood with tincture of guaiacum should be done ; the ozonic ether will turn green and the colour disappears on boiling.

2. If liquor potassæ is added to the deposit of pus a ropy, gelatinous mass results.

3. Examine under the microscope ; pus cells are seen.

Bile.—Bile occurs in the urine when there is some obstruction in the bile passages. It gives a greenish or brown-yellow colour to the urine, and on shaking it a permanent froth is present.

Test for Bile.—To some urine in a test-tube add impure (fuming) nitric acid, so as to form a layer at the bottom. Next to the acid there will be a yellowish-red ring of colour, above this a red ring, then a violet, and, highest of all, a green ring. The green is the important colour, as the others may be obtained without bile being present.

Urates.—When a concentrated urine is allowed to stand, as it cools an abundant brick-red deposit may occur. This is due to the presence of urates, and is

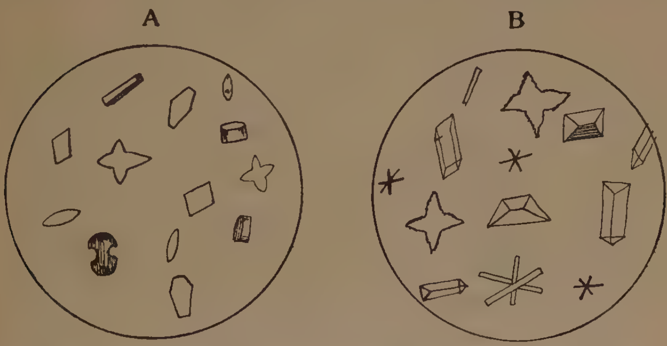


Fig. 22.—Microscopic Appearance of Crystals in the Urine. *a,* Uric acid; *b,* phosphates.

consistent with perfect health, although it may be frightening to the patient.

Tests for Urates.—1. Warm the urine; it soon becomes clear.

2. Add caustic soda; the urine becomes clear.

Uric Acid.—This may occur in the form of little red grains that are visible to the naked eye, and are known as the 'cayenne pepper' deposit. It is usually

found in patients suffering from 'gravel' or stone in the urinary passages.

Test.—Evaporate the suspected fluid to a small bulk. Place a few drops of it in a porcelain basin, and add 1 drop of nitric acid. Evaporate very slowly, so that it does not char. When almost dry, add to the orange-coloured residue a small drop of ammonia; a rosy-red colour appears at the edge of the drop.

Phosphates.—These are chiefly found in alkaline urine, and give it a milky-white appearance.

Test.—Add a little acetic acid; the urine becomes clear.

Specific Gravity.—The specific gravity of the urine is taken with the urinometer. The urine is allowed to cool, and is placed in a bell-jar. The urinometer is wiped clean, and placed floating in the centre of the jar. The eye is placed level with the surface of the urine, and the division of the scale to which the latter reaches read off.

Preparation of Patients for Kidney Operations.—There is nothing peculiar in the preparation of patients for an operation on the kidney.

The skin should be cleaned for a large area in the lumbar region behind, and the usual aperients should be given.

The most common operations are:

1. Nephrotomy, or cutting into a kidney, usually for stone.
2. Nephrectomy, or removal of a kidney.
3. Nephrorraphy, or fixation of a movable kidney.

After the operation the case is treated in the same way as a case of abdominal section, but the patient should be kept for some time on a milk diet, as this is less harmful to the kidney than meat. The patient should be encouraged to drink milk and soda, soda-water, or lemonade in large quantities, so that the secretion of urine is easy and free.

After the operation of nephrorraphy the foot of the bed should be raised by standing it on blocks.

Nursing after Bladder Operations.—Suprapubic cystotomy—*i.e.*, opening made into the bladder through the abdominal wall. In preparing these cases for operation an extra enema should be given about four hours before the operation, as the surgeon frequently has to introduce the finger into the rectum during his manipulations.

After the operation a tube will be left in the bladder through which the urine will constantly flow, keeping the patient wet. The bed should be arranged with a draw-mackintosh and a draw-sheet, as for a fractured spine (see p. 225), and if the patient be old a water-bed is necessary. Twelve hours after the operation the wound must be dressed, and the patient should be washed all over and the back thoroughly dried.

The dressings must be removed without disturbing the tube, the surrounding skin cleaned and dried, and then thoroughly smeared with some ointment, benzoin and zinc ointment or hazeline being the best. The wound is then covered with gauze and wool. Wool should also be placed on each side of the patient to absorb the urine as it trickles down. Cotton bandages and binders should be used instead of flannel, which are more difficult to keep clean, and which cannot be

boiled. A piece of jaconet over the dressing will help to preserve the bandages.

For the first four days the dressing must be changed every twelve hours, and each time the patient should be washed all over, the back attended to, and fresh ointment put on the wound.

After the fourth day the dressing should be changed every six hours, the patient being kept clean and dry.

In a favourable case, after the tenth day the patient should begin to pass urine down the urethra, and the dressing should be changed less often, the frequency depending on the amount of urine coming through the wound.

Diet.—This should be similar to that after an abdominal operation, but the amount of fluid given after the third day should be restricted, so that the amount of urine is diminished, but a sufficiency should be given to keep the patient quite comfortable.

Supra-pubic cystotomy is frequently done in children to remove a stone from the bladder. The dressing should be done in the same way, but the child must be fastened down with shoulder-straps, and the legs secured to the bottom of the cot with bandages, so that the child is kept in the dorsal position.

Care of Catheters.—Catheters are either made of soft indiarubber, gum elastic, black composition, or silver.

Silver catheters are usually in sets numbered from one to twelve, and are easily sterilized by boiling in the same way as other instruments. They should always be sterilized before use, and then placed in a weak solution of carbolic, or kept dry according to the wish of the surgeon. After use they are sterilized

by boiling, then placed in methylated spirit, thoroughly cleaned, and dried and put away in their case.

Soft indiarubber or Jaques catheters are also sterilized by boiling, and placed in carbolic lotion ready for use. They are useful also for nasal and rectal

Fig. 23.—Silver Catheter.

feeding, and are numbered from one to fourteen No. 7 is generally used for retention in women. No. 8 for nasal feeding, Nos. 10 to 12 for rectal feeding, and No. 13 for rectal wash.

Black catheters (French or olivary) are the catheters

Fig. 24.—French Olivary Catheter.

commonly used for men, and are numbered in two styles—French and English.

Roughly speaking, the same catheter number in English corresponds with twice the number in French.

Gum elastic and French catheters cannot be boiled, and they are cleaned in the following way :

Fig. 25.—Gum Elastic Catheter.

1. The eye of the catheter is placed under a cold-water tap, and the water allowed to run freely through.

2. Hot water is then run through the catheter in the same way for three minutes.

3. Syringe through the catheter with carbolic lotion (1 in 40), using a brass syringe.

4. (*a*) If put away wet, place the catheter in a glass tube containing carbolic lotion (1 in 40), taking care that the catheter is quite covered.

(*b*) If put away dry, syringe through with methylated spirit, allow to dry, and put away with a little French chalk.

Before using a catheter that has been kept in carbolic lotion, or in perchloride of mercury, it should be rinsed with warm boracic lotion.

The frequent cleaning and boiling of catheters is apt to make them rough, and they should be carefully felt before use, as if rough or cracked they should be destroyed.

FIG. 26.—COUDÉ CATHETER.

Female catheters are made of glass or silver, and can be sterilized by boiling. They are rarely used nowadays, male indiarubber catheters being used instead.

Washing out the Bladder.—This small operation is done in cases of cystitis (inflammation of the bladder) where the urine is decomposing in the bladder, and it is necessary to keep the mucous membrane clean.

A sterilized soft Jaques catheter (No. 8) should be passed into the bladder, and to it a funnel is attached by means of a short piece of glass tube and an indiarubber tube.

The lotion (temperature, 100° F.) should be poured into the funnel, and then the funnel elevated slowly,

so that the lotion flows quietly into the bladder. Not more than 5 ounces should be passed in at one time, otherwise the bladder will become over-distended and cause pain. When this quantity has been passed the fluid is allowed to run out by lowering the funnel, and the manipulation is repeated. Only weak, warm lotions of carbolic, sanitas or boracic should be used, as the bladder is covered with a delicate mucous membrane that can be easily damaged by strong antiseptics. When the lotion comes back clear the catheter is withdrawn and the genitals dried.

Another method is to force the lotion into the bladder by means of a syringe.

A catheter is passed and the syringe filled with fluid is attached to the end and the bladder slowly distended.

This method is a little more dangerous than the first, and if too much force be used the bladder may actually be ruptured, but with ordinary skill and care this will never occur.

CHAPTER XIX

BANDAGING

Materials—Methods of applying roller bandages—Principles of bandaging—Rules—Bandages for lower extremities—Perineum—Upper extremity—Slings—Breast—Head.

Good bandaging can only be learnt by instruction and practice on the human body, and in this chapter it is only intended to give the principles on which bandages are applied, and a few guides for their application in various parts of the body.

Bandages are made of the following materials :

1. *Linen, calico, and cotton.* Bandages of these materials are cheap, and can be washed. They should be sterilized by dry heat if they are to be used for aseptic wounds.

2. *Gauze*, plain or impregnated with some antiseptic chemical, such as bicyanide of mercury and zinc or carbolic acid.

3. *Domette.* This is a variety of soft elastic flannel. Bandages of this material fit closely to a part, and do not slip like the bandages made of stiffer material. They wash well, and should be sterilized by dry heat before use.

4. *Flannel.* This makes a firm, elastic bandage, and is especially useful in bandaging the chest and abdomen.

5. *Crinoline muslin* is used for making plaster-of-Paris bandages. It is better to use the unstiffened muslin, as it takes up more plaster.

6. *Elastic webbing and crêpe bandages* are special varieties of bandages used where even pressure is desired and to bandage limbs for varicose veins. They can be washed.

7. Martin's elastic bandages are used for the same purpose, but are irritating because they do not allow evaporation of the perspiration. Those perforated with small holes are to be preferred.

In emergency, bandages can be made of old linen—the older the better—and handkerchiefs can always be made to do duty for the more conventional surgical bandages.

Bandages nowadays are bought ready rolled, but in using a machine to wind washed bandages some difficulty may be experienced in withdrawing the centre pin of the machine from the bandage if it has been tightly rolled. To overcome this, the first few turns should be made rather slack, and after the bandage is rolled the complete roll should be grasped firmly in the hand, and the handle reversed for one or two turns. The centre pin will then be found to be easily removed.

The most important methods of applying the simple roller bandage are :

1. The spiral.
2. The reverse.
3. The figure of eight and its modification, the spica.

The spiral is made by simply encircling the limb with the bandage, each circle being made to cover two-thirds of the preceding one.

This bandage is applied to parts of uniform thickness, as, for instance, the fingers or the wrist.

The Reverse.—If the spiral bandage be applied to a limb, a point will be reached where the increasing thickness of the limb prevents the lower edge of the bandage being drawn tight. The thumb of the disengaged hand should be placed on the lower edge of the spiral about the centre of the outer side of the limb, and the bandage turned downwards on itself with the other hand. Both edges now firmly enclose the limb, and the bandage is made to encircle the limb again, and a second reverse is made in a line with the first, but on a higher level. These reverses are continued as often as necessary to make the bandage lie flat.

In the **figure of eight,** as its name implies, the bandage is applied in a series of loops above and below the point to be covered, so as to form the figure eight.

It is used to bandage parts that are very uneven, such as joints.

A modification of this is the **spica.** In it one of the circles is much larger than the other, and it is used especially in bandaging the shoulder and groin.

The principles under which bandages should be applied are as follows:

1. A bandage should be applied so as to keep up even, steady, firm pressure on the part, to keep the dressing in place, and to check hæmorrhage.
2. The bandage should be comfortable to the patient.
3. The bandage should be neat in appearance.

These should be carefully remembered in the application of each bandage, and at the same time the nurse must recognise the fact that departure from routine

is often necessary, and that a principle must never be sacrificed to conform with a rule.

Rules for Bandaging.—1. The bandage must be tightly rolled up before it is applied.

2. If possible, stand in front of the patient whilst applying a bandage.

3. Do not put a bandage next to the skin, except the special varieties such as Martin's or crêpe.

4. Do not let skin surfaces be opposed. Always separate them with a layer of cotton-wool, otherwise the secretions of the skin will cause irritation of the opposed surfaces. For example, in bandaging the arm across the chest, place cotton-wool under the hand and in the axilla.

5. Place the limb in the position it is going to occupy after it is bandaged, otherwise when the limb is bent part of the bandage will be too slack and part too tight. This especially applies to bandages covering the elbow-joint. If this be bandaged with the arm straight and then the elbow flexed, the forearm will be seriously constricted, and gangrene may result.

6. Always commence by making a couple of turns round the limb to firmly fix the bandage.

7. Apply the bandage from below upwards and from within outwards, passing over the front of the limb. This will prevent the congestion of the limb, which would occur if the bandage were applied from above downwards. The bandaging from within outwards is a matter of convenience only, and sometimes it is most important to bandage in the reverse direction.

8. Each turn of the bandage should overlap two-thirds of the turn below.

9. In reversing, the turns should be kept parallel

and at equal distances apart. The reverses should always be made downwards.

10. Use the figure-of-eight bandage for joints.

11. The bandage must be applied firmly and with equal pressure throughout. If this rule be not complied with, constriction of the limb followed by œdema and even gangrene may result. A watch must be kept on the extremities, and if œdema or discoloration occur, the bandage must be at once removed. This precaution especially applies to children.

12. Fix the bandage securely at the end. This is best done by means of a safety-pin, which should be inserted in the long axis of the bandage, and not across it. If it be fixed by tying, a reef-knot should be used. A reef-knot is a double knot in which both ends of the bandage pass in the same direction through each loop, and when it is tied the loose ends lie parallel with the turns of the bandage.

To Remove a Bandage.—To do this, reverse the manipulation that applied it, and gather the slack into a loose bundle, which is passed from one hand to the other round and round the limb.

Bandages for the Lower Extremity.—The foot should be bandaged with the simple spiral bandage starting at the head of the metatarsal bones, but it may be necessary to make a few reverses over the dorsum of the foot. When the ankle is reached, the bandage should be changed to the figure of eight, unless the heel is to be included. If this is so, the *divergent spica* should be used, which is another modification of the figure of eight. It is called divergent, because the first turn covers in the most prominent part of the heel, and from it the succeeding turns diverge, the next

going a little lower and catching up the slack of the first below, and the third going a little higher and catching up the slack of the first above. The remaining turns go alternately above and below the heel. The lower part of the leg is covered with a simple spiral, but as the bandage meets the swell of the calf, it is changed to a reverse, and this is continued to the knee, where it should be changed to the figure of eight. If it is desired to bandage the knee only, the divergent spica may be used. This will allow a slight amount of movement of the knee, and it should be put on with the knee slightly flexed.

Above the knee the thigh is bandaged with a series of spirals and reverses until the hip is reached. This should be covered with a spica.

To apply a spica bandage to the right hip, lay the free end of the roll of bandage on the anterior superior spine of the left side. Carry the bandage obliquely across the abdomen downwards and to the right, pass round and behind the right hip, and then upwards and outwards, so that it crosses the former fold. Carry it behind the body below the crest of the ilium, and then round the first starting-point.

Repeat these turns, making each $\frac{1}{2}$ inch above the lower edge of the last turn round the thigh. It will be seen that this is a figure-of-eight bandage, with a large loop round the body and a small loop round the thigh. To apply the bandage to the left hip, follow the foregoing instructions, reversing right and left.

To bandage both hips a double spica should be used.

It is important to notice that these and other bandages for the perineum and hips are applied round the pelvis, and not round the waist. In the latter

position they soon become loose, and if they are tightly applied they are apt to cut the patient.

Bandages for the Perineum.—1. The St. Andrew's Cross bandage consists of a series of loops applied alternately round the pelvis and across the perineum.

The bandage is begun on the right side of the pelvis, and a turn is first taken round the body to fix it. It then passes across the front of the right thigh and over the perineum, and, crossing the middle line, passes round the back of the left thigh and across the buttock to the pelvis, round which a turn is made. A second perineal turn is made in the same way as the first, only from the opposite side, the two turns crossing in the centre of the perineum.

Similar turns are added until the dressing is covered.

2. The T-shaped bandage is made by securing together two pieces of calico bandage so as to form the letter T. The horizontal part of the letter is to encircle the pelvis with the vertical part hanging down behind. The latter is brought forward between the thighs, and fixed in front to the former by splitting the ends and tying in a reef-knot.

It is best to bring the vertical part of the bandage up on one side of the external genitals, and not to split it, and pass half on one side and half on the other. This bandage should be made of 4-inch roller bandage. As a rule, they are made too narrow and too flimsy, so that they easily roll up into a cord, and cut the patient.

3. A triangular bandage may be used for the perineum, especially if fomentations are being applied. A roller bandage is passed round the pelvis to form a belt, and the apex of the triangular bandage is tied to it

behind. The base is carried between the legs, spread out, and fixed to the belt in front.

A modification of this with the base of the triangular bandage going round the thighs and the apex secured to the belt is very useful for securing on the hip a dressing which has to be frequently changed.

Bandages for the Upper Extremity.—In bandaging the fingers, hand, and forearm, the limb should be held in the position of pronation (*i.e.*, with the palm downwards), and if possible the thumb should be left free.

It is rarely necessary to bandage the fingers separately, and when one or two fingers have to be covered they may be bandaged together with a simple spiral, but the bandage should be secured by a figure of eight round the wrist, the crossing of the bandage being on the dorsum of the hand. To secure a dressing on the hand, the simple spiral should be used with a reverse if necessary, and this should change at the wrist to the figure of eight. The lower part of the forearm is bandaged with the simple spiral, but as the bandage ascends it is changed to the reverse. When the bandage reaches the elbow, which should be held flexed, it is made to encircle the joint by carrying the roller once horizontally round the centre of the joint without reversing, taking care to apply the centre of the bandage over the bony prominence of the olecranon. The bandage is now carried round at a somewhat lower level than the horizontal turn, and by encircling the arm at this point, makes the lower loop of the figure of eight. The bandage is now brought round the joint at a slightly higher level than the horizontal turn, thus completing the upper loop of the eight. These figures

of eight are then continued, the loops being taken above and below the horizontal turn until the joint is sufficiently supported. The arm is bandaged by a series of spirals and reverses, as in the forearm, until the shoulder is reached.

The shoulder should be covered with a spica similar to that of the groin, and it is usually necessary to place a piece of cotton-wool in the axilla. The large loop of the spica must go round the chest and under the opposite axilla, and not round the neck, otherwise the bandage will quickly become loose and inefficient.

The spica should be ascending—*i.e.*, the first turn round the arm is the lowest.

The triangular bandage may be used for the shoulder, the base encircling the arm and the apex fixed to a band passing across the chest under the axilla of the opposite side and above the shoulder of the same side.

After bandaging the upper extremity, the limb is usually supported in a sling, the most convenient form of which is the tringular bandage.

In applying the sling, the apex of the triangle is placed toward the elbow. The ends are carried round the neck, either directly or crossed, and tied in a reef-knot. The apex of the bandage is folded neatly round the elbow, and secured with a safety-pin.

Many-tailed Bandage. — The many-tailed bandage is chiefly used when frequent dressing of the part is necessary, as when fomentations are being applied, or when it is particularly important not to disturb the limb.

It consists of a backbone, to which are sewn at right angles a number of shorter pieces, which are made to overlap one another for two-thirds of their width,

and are long enough to encircle the limb once and a half.

To apply it, the backbone is placed along the posterior aspect of the limb, and the lowest turn is folded into position over the dressing, and successively covered by all the others. The last turn is fixed by a safety-pin.

Another way to make the bandage is to take a sufficiently long piece of bandage material and make the backbone and the tails by appropriate cutting, no stitching being used. In this case, of course, the tails do not overlap, and the result is not quite so neat as the more elaborately made one, but it answers the purpose just as well.

Sayre's Method for Bandaging Fractures of the Clavicle (Collar Bone).—Two pieces of stout strapping, 3 inches wide, and long enough to go one and a half times round the body, are taken. A piece of cotton-wool, powdered with boracic powder, is placed in the axilla. The first piece of strapping is looped round the arm just below the axilla, and secured with a few stitches. The strapping is then warmed, or smeared with a little turpentine, and carried round behind the body and below the arm on the opposite side, and then across the chest and inside the injured arm, and finally secured at the back. The forearm is now laid on the chest, with a piece of cotton-wool under it, and the second strap is warmed and fastened on the sound shoulder. It is then carried down across the back to the elbow on the injured side, and then along the back of the forearm over the hand to its starting-point. As the strap is crossing the elbow, the arm is pressed a little forwards so as to throw the shoulder backwards. It is best to

fasten the plaster with a few stitches, otherwise it is sure to work loose. The straps must not be put on mechanically, but the fracture must be examined to see that the fragments are in apposition and the deformity corrected. After the strap is fixed, the arm should be further supported with a wide bandage following the paths of the strapping round the chest and across the shoulder, or, better, a few turns of a plaster of Paris bandage may be applied over the plaster.

To Bandage the Right Breast.—Apply the end of a 4-inch roller bandage about 3 inches below the right breast, and secure it by two horizontal turns round the body from right to left. Carry the bandage upwards from under the right breast in front of the chest over the left shoulder and across the back, bringing it to the front at a slightly higher level than the horizontal turn. Continue the turn horizontally round the body, keeping it at a higher level than the first one. On reaching the right breast again, the roll is carried up to the left shoulder, this time covering a small portion of the breast, and thence obliquely across the back, until it once more joins the horizontal in front below the right breast. These turns—the horizontal and the oblique—are alternately repeated, each at a higher level than the preceding one, until the breast is covered. This, it will be seen, is merely a modification of the figure-of-eight bandage.

Bandages for the Head.—The four-tailed bandage is used for fractures of the lower jaw, and to secure dressings on the chin. It consists of a piece of bandage material, 1 yard long and 3 inches wide. This is split longitudinally, except for about 4 inches in the middle, and in the centre of the unsplit part a

small hole is cut. The chin is fixed into the hole, and the two anterior tails are carried backwards and tied above the occipital protuberance, whilst the two posterior tails are tied over the crown of the head.

The ends of the tails are now tied together, to prevent slipping.

The capelline bandage is a very secure bandage for fixing dressings on the head, but it is very hot, and is now seldom used.

To make it, fasten two 2½-inch roller bandages together, and wind off rather less than half of one on to the other, thus making a double-headed roller, with one head about three times as large as the other. Stand behind the patient, who is best seated, and take the large roller in the left hand and the small one in the right. Apply the bandage to the forehead, first above the eyebrows, and pass each roll horizontally backwards till they meet behind below the external occipital protuberance. Cross the large roll over the small one, and transfer the large roll into the right hand and the small to the left hand, and pull the bandage together.

Now carry the small roll upwards along the middle line over the head and down to the root of the nose. Bring the large roll horizontally forwards above the right ear, making it cross, and then fix the small one at the root of the nose. Take the small bandage back to the occiput again a little to the left of the middle line, and fix it behind as in front, by a turn of the large bandage. Bring it once more to the front, a little to the right of the middle line, and again fix it with the large one.

Continue these turns on either side of the middle line, fixing each with a horizontal turn until the whole

of the vault of the skull is covered, when the bandage is secured by a couple of turns of the horizontal bandage round the head and pinning it in front.

The triangular bandage is very useful for the head, as it is light, easy of application, and secure.

A triangular bandage is laid on the top of the head, with the base passing straight across the forehead and the apex lying on the occiput. The ends are carried round to the back of the head, where they cross below the external occipital protuberance, and then pass above the ears to the front, where they are tied with a reef-knot.

The apex is turned up over where they cross on the occiput and secured with a safety-pin.

Unna's bandage is used in cases where an equitable pressure is desired, as a case of varicose ulcer of the leg.

The skin round the ulcer is thoroughly disinfected by washing it with soap and water, and subsequently with antiseptic lotions. The ulcer is cleaned and powdered with iodoform and boracic powder. A double-headed carbolic gauze bandage is taken and applied to the limb, commencing from the middle of the sore and going up and down.

Into the bandage is rubbed a mixture of gelatine and glycerine—10 parts of gelatine, 40 parts of water, 40 parts of glycerine, with some oxide of zinc. This mixture is heated in a water-bath, and whilst hot is rubbed into the bandage, and before it is set another bandage is dipped into hot water and applied. The dressing solidifies, and forms a firm support for the leg, and while it does not have the weight of a plaster of Paris bandage, the pressure is more evenly distributed than with an elastic bandage.

For plaster of Paris and other bandages, see p. 211.

CHAPTER XX

INFANTS

Weight — Fontanelles — Teeth — Respiration — Pulse — Stomach — Feeding—Amount of food required—Times of feeding—Crying —Saliva—Walking—Sleep—Clothing—The abdominal binder —The napkin—Shirt—Petticoat—Dress—The nightdress.

THE child during birth and immediately afterwards belongs to the gynæcologist, and in the early years of life the infectious fevers and their complications and sequelæ are so common that the physician is more frequently called in than the surgeon. But during infancy there are many deviations from the normal that require surgical treatment, and that bring the child under the care of the surgeon and the surgical nurse. For example, there are the various congenital deformities such as hare-lip, cleft palate, talipes, and imperforate anus, some acute abdominal diseases, such as intussusception, and some chronic diseases, such as tubercular peritonitis and syphilis. Burns and scalds are more commonly seen in the child than in the adult.

In other cases the surgeon must work with the physician, as in the treatment of rickets and infantile palsies, the latter curing the general disease, whilst the former prevents the deformities which are so frequently seen during the course of these complaints.

The surgical nurse must, therefore, know certain facts about the young developing child, and the methods of feeding and clothing it, and these facts it is proposed to give in this chapter.

Weight.—The weight of the newly-born infant averages 7 pounds, the males being a little heavier than the females. A living child born weighing 18 pounds 15 ounces has been recorded, and children under 5 pounds have lived and thriven; but if a child is born at term weighing less than 5 pounds, it is very unlikely to survive.

The weight of a child is of great importance in estimating its vitality and the effects of treatment. In all cases of artificial feeding and in illness the child should be weighed regularly, and even in health it is advantageous to keep a record of the weight, as in some instances a fall in the weight has indicated the onset of disease before any other symptoms attracted notice.

The following table gives the average weights of a child at various periods of life:

Fifth month	should be	14	pounds—*i.e.*,	twice	the weight	at birth.
First year	,,	21	,,	thrice	,,	,,
Sixth year	,,	42	,,	six times	,,	,,
Fourteenth year	,,	84	,,	twelve times		,,

After birth the weight of a child diminishes for a day or two, but it should recover this loss by the end of the first week, and then steadily increase.

Fontanelles.—These are spaces in the cranial vault filled in with a strong membrane, and mark the meeting-points of the various bones of the skull. The most important are the anterior and the posterior fontanelles.

The anterior is easily felt, and the membrane closing it should be level with the skull bones. If it be depressed, it indicates a condition of shock ; and if it be elevated, a condition of increased intracranial pressure.

It can normally be felt to pulsate with the heart's beat, and the membrane becomes tenser when the child cries.

The anterior fontanelle should close early in the second year (fifteenth month), and if it remain open after this time it indicates disease—usually either rickets or hydrocephalus.

The posterior fontanelle should not be appreciable after birth, and if it be easily felt, indicates disease.

Teeth.—The child may exceptionally be born with some of the teeth already erupted, but usually the first milk or temporary tooth makes its appearance in the seventh month.

There are twenty milk teeth in all—five on each side in each jaw—and they are named from before backwards, the central incisors, the lateral incisor, the canine, the first premolar, the second premolar.

The first tooth is usually the lower central incisor, and this is followed by the corresponding one in the upper jaw. The rest of the teeth appear in order, the lower tooth coming through before the upper, and the first dentition is complete in the normal child by the end of the second year.

Delayed dentition usually occurs in rickets, but serious trouble, directly due to the eruption of the teeth, is not common, and lancing of the gums to help the teeth to come through is rarely necessary.

The first permanent tooth to appear is the lower first molar, and it usually is cut about the sixth year.

Respiration.—The child breathes more quickly than the adult, and the respirations are best counted by watching the abdomen, and not the thorax.

In the newly-born infant the respiration-rate is 40 per minute, at the end of the second year 30 per minute; and at the end of the fifteenth year it has fallen to 20 per minute. The respiration-rate is very easily disturbed, and in slight bronchial affections will readily rise to 60 or more.

Pulse.—The pulse-rate is also quicker than in adults.

Newly born	130 per minute.
Second year	110 „
Twelfth year	80 „

Like the respiration-rate, it is easily altered by slight causes. A fit of coughing or crying may raise it 20 beats in a minute, and for this reason the pulse should always be counted when the child is quite quiet.

Stomach.—The capacity of the newly-born child's stomach is about 1 ounce—*i.e.*, 2 tablespoonfuls—and this is the amount of fluid that should be given at each meal. It rapidly increases in size during the first year.

Capacity of stomach at one month	2½ ounces.
„ „ two months	3 „
„ „ five „	3½ „

If too much food be given, the stomach is over-distended, and the infant usually vomits, but too

RICKETS.

SKELETON SHEWING ADVANCED RACHITIC DEFORMITY

much stress must not be laid on these capacities, and the feelings of the child, as expressed by crying or turning away from food, must be taken into account during feeding.

Feeding.—It is not proposed to discuss here the natural breast-feeding of infants, but to give a few directions about the kind and the amount of food that infants and young children require.

When human milk cannot be obtained for the growing infant, it is desirable to substitute for it the combination of elements which such human milk represents. To accomplish this, it is necessary to have materials which, while resembling the elements of human milk, are easily obtained.

The food which approaches most nearly to the product of the human mamma is that produced by the mamma of other animals, and this food is an animal and not a vegetable one. Although other animals produce milk more closely resembling human than the cow, yet the cow's milk is so universal and so easily obtained, that it should always be used for substitute feeding.

The various other foods used — patent or otherwise — depend for their basis on cow's milk, or without the addition of milk they would show but an insignificant percentage of any of the most important ingredients of the natural food; it is necessary to thoroughly understand this, for then the apparently successful results of innumerable foods will be explained.

Fresh cow's milk properly modified is, then, the substitute for human milk for feeding the normal infant, and no other kind of food should be considered

for a moment, unless it be impossible to obtain a supply of it.

In cases of disease, however, if it be found by examination of the stools that cow's milk is not being digested, other substitutes will often be tried with success; but the elaborate system by which cow's milk is now modified will probably produce a milk which the child can digest. If the reader wishes to learn more about the artificial feeding of infants and the modification of cow's milk, she is referred to 'Pediatrics,' by Rotch.

It may be of interest to give here tables showing the resemblance and difference of human and cow's milk.

PERCENTAGE COMPOSITION OF COW'S AND HUMAN MILK.

	Caseinogen (Proteid).	Fat.	Milk-sugar.	Salts
Cow's milk ..	4·6	4·0	3·8	·6
Human milk ..	3·0	3·5	4·6	·6

It will be seen that the amount of salts in the two milks is identical, and the amount of fats is very similar, human milk containing only a little less than cow's milk.

Cow's milk, however, contains more of the proteid caseinogen, and this in the stomach is altered into casein, an insoluble proteid. The 'curd' formed from cow's milk is firmer and larger than that formed from human milk, and this is one of the difficulties of artificial feeding with cow's milk.

The percentage of sugar in cow's milk is less than that in human milk, and this is the reason for the addition of sugar in infant feeding. The exact amount to be added is 40 grains to a 4-ounce feed, or, roughly, a lump of white sugar to $\frac{1}{4}$ pint of milk.

RICKETS.

SHEWING BOW LEGS AND ENLARGED EPIPHYSES.

RICKETS.

SHEWING (1) ENLARGED EPIPHYSES; (2) PROTUBERANT ABDOMEN; (3) CURVES IN THE BONES; (4) LARGE HEAD.

THE SITTING POSITION OF THE CHILD SHEWS THE WAY IN WHICH

Amount of Food Required.—The following table gives the amount of food averaged by 341 thriving infants (Rotch):

TABLE OF FOOD.

Age of Child.	Milk.	Barley-water.	Total Amount given at each Feed.
	Tablespoonfuls.	Tablespoonfuls.	Tablespoonfuls.
During first fortnight ..	1	2	3
,, second ,, ..	2	3	5
,, two months ..	2	3	5
,, three ,, ..	4	4	8
,, four ,, ..	5	4	9
,, five ,, ..	6	4	10
,, six ,, ..	8	4	12
,, seven ,, ..	9	4	13
,, eight ,, ..	10	4	14
,, nine ,, ..	12	4	16

Barley-water is best made by taking a teaspoonful of prepared barley (in powder), adding it to 1 pint of boiling water, and then boiling for five minutes. It must be made fresh each day, and kept covered in a cool place. If water be used to dilute milk, it must be boiled.

The following table gives the amount in ounces that should be given at each feed between the ages of one month and ten:

At birth - - - -	1 ounce at each feed.
,, one month - - -	$2\frac{1}{4}$ ounces at each feed.
,, two months - - -	$3\frac{1}{3}$,, ,, ,,
,, three ,, - - -	4 ,, ,, ,,
,, four ,, - - -	$4\frac{1}{2}$,, ,, ,,
,, five ,, - - -	$5\frac{1}{4}$,, ,, ,,
,, six ,, - - -	$5\frac{3}{4}$,, ,, ,,
,, seven ,, - - -	6 ,, ,, ,,
,, eight ,, - - -	7 ,, ,, ,,
,, nine ,, - - -	$7\frac{1}{2}$,, ,, ,,
,, ten ,, - - -	8 ,, ,, ,,

If a child is being fed on milk and barley-water, the following proportions should be used :

First fourteen days of life,	1 part cow's milk	to	2 parts barley-water.
Second ,, ,, ,,	3 parts ,,	,,	1 part ,, ,,

A little white sugar should be added to each feed, and the milk given at a temperature of 98° to 99° F. If ordered, a small quantity of cream should be added.

Times of Feeding.—For the first two months the child should be fed every two hours ; during the third month, every two and a half hours ; and then, up to the eighth or ninth month every three hours.

In acute illnesses, such as after a laparotomy for intussusception, feeding should be more frequent. Children should not be wakened up for feeding in the normal state, although in illness it may be necessary to do so.

After eight months of age, and if the child has teeth, he may be given bread and milk, bread-and-butter, milk-puddings, a little red gravy, with bread-crumbs or mashed potato, or the yolk of an egg once a day at the mid-day meal. It is advisable to vary the diet occasionally, giving him gravy one day and the egg the next, and so on.

After nine months eggs, mutton-broth, or bread fried in bacon fat, may be added to the dietary.

Fish or meat should not be given before the child is eighteen months old, and when given it should be finely minced. Tea or coffee ought not to be given to children under five years of age. They are merely stimulants, and quite unnecessary, if not actually harmful.

No alcohol should be given to children except by order of the surgeon.

The following articles of diet should not be given to children under three: New bread, peas, beans, turnips, carrots, pickles, pastry, buns, cakes, sweets, jam, syrup, treacle, biscuits, condensed milk, or patent foods.

Crying.—The lachrymal (tear secretory) glands are not functional at birth, and the child is usually three or four months old before tears are shed when it cries. In serious illness the lachrymal secretion often disappears again, and its return may be taken as a sign of improvement and convalescence.

Saliva.—This is present and even abundant in early life, but it does not contain the ferment (ptyalin) that gives it its digestive action upon starch. The pancreas also does not secrete its starch-splitting ferment until about the ninth month, and it is for this reason that all starchy foods are contraindicated in the dietary of the infant.

Walking.—The legs of the infant are not straight, the tibia and fibula being bowed inwards, but by the time the child begins to walk they should have become straight.

A normal healthy child will hold its head up between the second and third month of life, sit alone in the eighth month, crawl at ten months, stand alone at twelve months, and walk at fifteen months.

All these dates are liable to variations, and it is a great mistake to encourage early sitting or walking. As soon as a child feels itself strong enough to sit or stand, it will begin to do so, and if it be placed on its legs and encouraged to walk before its inclination, flat-foot or other deformities will occur.

Sleep.—A child should be allowed to sleep as long as it can naturally, and if healthy, it should never be wakened to give it food, but in disease it may be necessary to do so.

From the first days of infancy it should be taught to sleep in a cot by itself, and it should never be allowed to sleep with an adult.

Clothing.—Any exposure of the body or limb in either infants or children is unwise; but a very important factor in the problem of growth is perfect freedom of motion for its legs and arms, and for the respiratory and abdominal muscles. Too little warmth and too great warmth will both be harmful, and the clothes must not exert pressure on any part of the body. All useless stitches, buttons, tapes, and articles of clothing should be dispensed with, and a method adopted which, while combining the necessities of clothing, allows the child to be quickly dressed and undressed.

The abdominal binder should be left off after the third week of life, as it has no use in preventing either umbilical or inguinal hernia. The band should be replaced by a knitted garment with shoulder-straps to hold it in place, and a tape in front to fasten the napkin. This garment should be either of soft wool or silk.

The napkin is best made of soft absorbent gauze cut from a roll, and burnt as soon as soiled. The ordinary napkin is much too thick and heavy, and helps to produce the deformity known as bow-legs.

Shirt.—The shirt is made of some soft all-wool material, with long sleeves, high neck, and reaching to the feet, and made to button at the back.

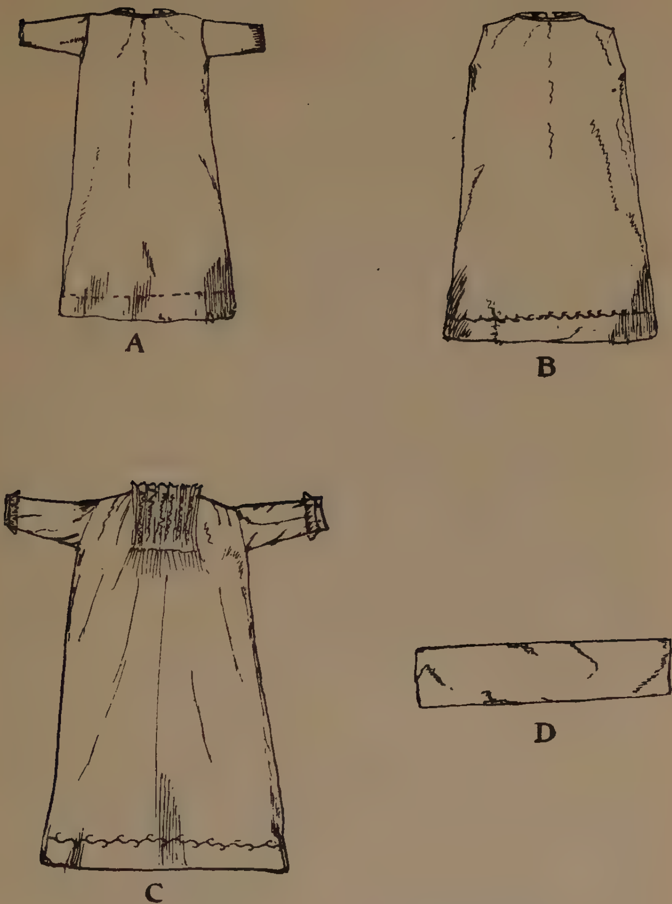


FIG. 27.—INFANT'S LONG CLOTHES (After Rotch).

a, Shirt ; *b*, Petticoat ; *c*, Dress ; *d*, Flannel binder for use in the first fortnight.

Petticoat.—This is a somewhat similar garment to the last, but with a low neck and no sleeves. It also should button at the back, and be made of flannel.

Dress.—This should be made of some soft white material, and be large enough to cover the shirt and the petticoat. It should have a high neck and long sleeves, and should be made to button up behind, so that all the garments can be unfastened without turning the child about. An infant in long clothes does not require socks or shoes, but there is no great objection to small knitted socks if the mother desires them.

When the child is old enough to be put into short clothes (about ten months), the under-garments can be replaced by an all-wool under-garment, with high neck and sleeves, and the legs should be covered with white wool stockings, which are kept in position by being pinned to the napkin, and when the child begins to walk, soft kid shoes should be used, with the soles adapted to the natural curves of the foot, and not 'straights.'

Children's shoes should be rights and lefts, like those of adults.

The night-dress should be made of soft flannel, with a high neck and long sleeves, and buttoned behind. This is usually the only garment necessary, but in cold weather an extra garment of knitted wool can be worn under the night-dress if it be considered advisable for the particular child.

CHAPTER XXI

MASSAGE

Definition—Uses—Terms used—Lubricants—Stroking—Percussion—Kneading—Passive movement—Resistance movements—Movements of the joints—Massage—Special cases—Weir-Mitchell treatment.

Definition. — Massage is the scientific manipulation of the skin, muscles and fasciæ of the body, and has for its objects the following :

1. To improve the functions of the skin.
2. To attract the blood to the surface from the deeper parts.
3. To quicken the flow of blood and lymph through a part.
4. To remove adhesions and the products of inflammation (see p. 19).
5. To increase the nutrition of the part.
6. To counteract constipation.

Passive movements are movements of the joint performed by the operator without the assistance of the patient. They are used to prevent the formation of adhesions due to inflammation. At the same time they quicken the flow of blood and lymph, and so help in the removal of effete products.

To massage scientifically and not to be a rubber, a nurse must have an intimate knowledge of the joints and muscles of the body.

This knowledge must include the movements that the joint can perform in health, and the nature and extent of the synovial membranes of the tendons that surround it, as well as the origin, insertion, and the action of the muscles. The scientific masseuse is able to map out under the skin the muscles and organs of the body in health and disease.

This knowledge can only be obtained from the study of the special text-books devoted to the subject, and here it is merely intended to give a few of the more important rules that guide the professional masseuse, and which it is hoped will allow the nurse to give much benefit to her patient when the attendance of a specialist in this department of surgical nursing is impossible.

Massage should only be used under the orders of the surgeon, for although rubbing is one of the most important methods of relieving pain, it must not be used indiscriminately, or much harm may be done. For example, if the pain and swelling caused by a recent clot in the veins be treated with massage, there is great danger of the clot being dislodged and set free in the blood-stream, a condition which may have a fatal result.

The principal terms used in massage are four in number :

Effleurage, or light stroking movements to the skin.

Pétrissage, deep movements on the muscles, which are kneaded, rolled, and squeezed.

Friction or deep movements, in which the skin and superficial tissues are made to move over the deeper tissues ; chiefly used over joints, or where the tissues are swollen and thickened.

Tapotement, or percussion movements, the part

being lightly and rapidly struck with the back or side of the hand or the fingers.

These main classes of movements are divided into many others, but for practical purposes, as far as concerns the treatment of injured joints and muscles, the various manipulations can be grouped under the heads of (1) stroking, (2) percussion, (3) kneading, giving the terms their ordinary unscientific meaning, and under this classification the various movements will be described.

When a limb is to be massaged, the patient should be made quite comfortable, the part well exposed and supported on a pillow in an easy and natural position, so that all the muscles are relaxed.

The masseuse should be seated, as a rule, facing the patient, and at a comfortable distance from him, so as to be neither cramped for room nor strained. It is imperative that in all the movements there should be no jerking, especially if the part be painful, so that the patient may not start, and the whole procedure from first to last should be without pain.

It is also important that after massage and passive movements there should be no signs of bruising directly due to the manipulations. In recent sprains and fractures there will be, of course, an extravasation of blood under the skin, and part of the use of massage is to remove this, but bruising never occurs due to massage, unless the force used has been excessive, and its presence generally means that more harm than good has been done. Instead of diminishing the extravasation, it has increased it, and the process of repair is hindered by further inflammation, due to the fresh injury.

It, however, must be recognised that during a

séance the blood will be rubbed along the planes of the tissue, and when the part is seen next day the bruising will extend all up the limb.

Lubricants for the Hands.—In massaging, the hands should not slip too much upon the skin, which should move with them as far as possible, or the manipulation may be uncomfortable to the patient. For this reason ointments and other similar applications are better avoided, unless it is either wished to diminish friction or to produce some specific effect.

Under some circumstances, however, a lubricant should be used, and one of the following is satisfactory: pure olive-oil, neat's foot oil, or lanoline.

Medicated oils or ointments should never be used except under the surgeon's orders, and the process of rubbing them in is termed inunction, and this must not be confused with massage.

It is used when it is advisable or necessary for the patient to absorb drugs through the skin, and not to take them by mouth.

The conditions in which lubricants should be used are as follows:

1. When a limb has been kept for some time in splints or plaster of Paris. In these cases the skin will desquamate, and a shower of small particles of the epidermis will come off when the limb is rubbed. Oil will diminish the amount of friction, and prevent the small particles from flying about.

2. Over lately healed wounds. In these cases the ointment will diminish the amount of friction, and prevent pain.

3. When the patient is very emaciated, aged, or young.

4. When the skin of the patient or the hands of the operator are damp and coarse.

If massage be done clumsily, or the hands of the masseuse are not dry and soft, marks, or even abrasions, may follow.

Beginners and unskilled masseuses will find it easier to rub with lubricants, but, as stated, their general use is not advisable.

1. **Stroking.**—This is the most simple of the three movements, but its power is limited to the superficial structures, and it has no direct influence on the deep.

It consists of a succession of strokings with the hands or fingers (using as much of the surface as possible), care being taken to fit into all the inequalities of the limb.

The strokings should always pass from the extremities towards the trunk, and they should commence lightly and gradually increase in strength as the part becomes used to them.

It will be found that after stroking has been used for a little time the skin becomes warm and reddened ; more blood passes through it, and the surface temperature is raised, and after a few sittings the nutrition of the skin will be distinctly improved.

Stroking also exerts a considerable influence upon the nerves distributed to the skin, it allays the sensitiveness in recent injuries, and leaves behind it a sense of warmth and comfort. It prepares the patient for the firmer kneading of the muscles, and is of great use in the beginning of treatment of recent sprains and fractures.

In doing the movements the fingers are held straight and close together, and the hand is not lifted at the

end of the stroke, but glides back to where it started without exerting any pressure.

The movement should be done quickly, unless the parts are very swollen and tender, or a soothing movement is required. Stroking is also employed as a finishing movement to kneading or percussion at the end of the sitting.

2. **Percussion.**—Percussion is carried out by means of instruments, or with the hands. If the hands are used, the movements should be light, and the hands are not raised more than an inch from the patient's body. It is a manipulation that has a very limited application in the treatment of recent accidents, and had better be left to the trained masseuse.

3. **Kneading, or Massage Proper.**—This is essentially a deep movement, in which the muscles and their tendons are kneaded, rolled, and squeezed, but it is important to commence as gradually and as gently as possible, especially in recent injuries. The deeper tissues must only be manipulated after the superficial ones have become thoroughly accustomed to the pressure, and have been unloaded of their superfluous fluid.

The skin, the subcutaneous tissue, and the muscles must all be worked upon in turn.

The manipulations should not be confined to the injured parts, but the whole of the limb should be treated. It is best to devote the attention at first to the parts nearer the trunk than the injury, then to deal with those round the injured area, and finally to manipulate the seat of injury itself. The more tender spots should always be left to the last; these will usually be the most swollen parts of the limb, and

after massage has been applied to the surrounding parts, it will often be found that a good deal of the swelling has disappeared, and owing to the increase of the circulation around, the remainder of the effusion will be readily absorbed. The direction of the movements must always be towards the trunk from the insertion to the origin of the muscles, in the direction of the returning current of the circulation, and commencing over a part where no swelling appears, gradually working on to the rest. The movements should be done with the thumbs, the tips of the fingers, or the palms of the hands, according to the shape of the part, taking care to employ as much surface as possible.

The two hands should be used close together, and as the sitting proceeds the tips of the thumbs or of the fingers should be made to trace out the irregularities between the bony prominences, sweeping round in small circles on the skin.

As the effusion subsides, the circles increase in size, the pressure becomes firmer and firmer, and the deeply-lying structures are treated in their turn.

The muscles are grasped between the fingers and thumb, and squeezed in the direction of their fibres, and the tissues are firmly pressed until all the excess of fluid has disappeared.

The rate of movement and the amount of force that is used vary with each case, and should always stop short of causing pain or bruising the part. After kneading, the sitting should end with friction of the whole limb.

Length of Sitting.—This, of course, varies with the case, but the usual tendency is to make it too long.

In the case of a recent injury, fifteen minutes is a good average, and the first ten minutes should be spent over stroking and the preparatory movements, five minutes being all that is necessary for deep manipulation. Short, frequent sittings are of more benefit than are long ones.

Passive Movements.—These movements act on both the muscles and the joints, stretch the muscles, prevent adhesions between them and their sheaths, and stimulate them so that they do not atrophy. In the joints they prevent adhesions from joining the two bony surfaces together and from forming in the tissue round the joint, and so rendering it stiff and painful.

In doing passive movements, the limb should be entirely surrendered to the manipulator, and the joints should be firmly and slowly put through all their movements until a distinct feeling of resistance is experienced.

In some cases where adhesions have already formed, or after operations on joints, the movements will have to be firm enough to cause pain, but this should never be excessive, and should pass off immediately, and bruising should not follow.

The movements chosen are those most suitable for the given case, and sufficient time must be given to each movement to make it efficient.

Resistance Movements.—These are used to strengthen the muscles, increase their activity, and aid the nutrition of the tissues generally.

The patient carries out a definite course of action against the manual resistance of the operator, who

selects a particular group of muscles, and exactly regulates the amount of work.

Exercise of this kind is most valuable, the secret of success being to keep the opposing force well within the patient's strength, making use alternately of the different movements that the joint is capable of performing. With a moderate amount of care, these movements may be kept up for a considerable time each day, but they should always stop short of fatigue, and the patient should have a thorough rest afterwards.

A nurse who knows the actions of the various joints can readily arrange a system of exercises which will be to the best advantage in any given case.

The following are the movements allowed at the most important joints of the body :

Shoulder.—Movements in every direction, forwards, backwards, abduction, adduction, circumduction, and rotation. It is important that the scapula be well fixed with the other hand whilst the shoulder is being moved.

Elbow.—Flexion and extension between arm and forearm. Radio-ulnar, forward rotation or pronation, backward rotation, or supination.

Wrist.—Flexion, extension, abduction, adduction, and circumduction.

Fingers.—Flexion and extension.

Hip.—All movements as shoulder.

Knee.—Flexion and extension.

Ankle.—Flexion and extension.

Mid-tarsal.—Flexion, extension, eversion, and inversion.

Toes.—Flexion and extension.

Movements should not be done until massage is completed, and should be followed by stroking.

Massage in Special Cases.—1. Recent sprains of ankle. Treatment should start with friction with the flat of the hand from the ankle to the knee, the limb being supported and raised. This is followed by light kneading with the tips of the fingers, avoiding the most painful spots, and the whole foot being gone over. Passive movements of extension and flexion should follow, and the sitting should last about ten minutes.

As the fluid is absorbed, the manipulations should become more vigorous and rapid, and the sitting lengthened, the muscles being thoroughly kneaded. The limb should be kept bandaged between the sittings.

All recent sprains are treated in the same manner, and if it be the wrist that is suffering, the fingers are moved at each sitting.

2. **Recent Fractures.**—The splints or sand-bags must be carefully removed, so that the fragments of the bone are not displaced. The first manipulations must be very light, stroking being the only movement allowed, and this must be done as quietly as possible. The movements gradually become more vigorous at each sitting.

In readjusting the splints to the leg, it must be seen that the foot is at right angles to the leg, and that the heel fits closely to the angle of the splint.

3. **Pott's and Colles's Fractures** (see p. 218).—These fractures are usually treated from the first by massage, combined with splinting. Passive movements of the ankle and toes in Pott's fracture, and of the fingers and wrist in Colles's fracture, must be started at once to prevent subsequent stiffness.

After massage it is important to see that any dressing or splint is replaced in exactly the same way as it was left by the surgeon. Any increase of temperature or marked alteration of the limb should be at once reported to the surgeon.

4. **Weir-Mitchell Treatment.**—This is a system of treatment that includes isolation, rest, excessive feeding, massage, and the use of electricity.

The massage and electricity are used to counteract the effects of the rest and feeding, and the massage is general to the whole body. This treatment is chiefly used in cases of hysteria.

The massage should begin within the first two days of confinement in bed, and should start with gentle rubbing of the whole body for fifteen or twenty minutes. This should be done for the first three days, and should then change to thorough deep massage of the entire surface of the body and limbs, excluding the head and neck, and be rapidly increased in duration to an hour or an hour and a half daily.

Thorough massage of the abdomen is especially desirable in view of the frequency of obstinate constipation in these cases.

APPENDIX

ENEMATA FOR EMPTYING LOWER BOWEL.

(*a*) *Soap and water.*

Soap and water ... ... 2 pints.

(*b*) *Turpentine.*

Turpentine ... ... 2 ounces.
Warm water ... ... 2 pints.

Mix well together.

(*c*) *Alum.*

Alum ... ... 1 ounce.
Warm water ... ... 1 pint.

(*d*) *Olive oil.*

Olive oil ... ... 4 ounces given with Higginson's syringe, followed by soap and water, or mixed with soap and water.

(*e*) *Glycerine.*

Glycerine ... ... 2 drams warmed for adults.
1 dram warmed for children.

(*f*) *Valerian.*

Tinctura valeriana ... ... 1 dram.
Warm water ... ... 1 pint.

(g) Salt.

Salt ... ... 1 ounce.
Warm water ... ... 1 pint.

ENEMATA FOR COMBATING SHOCK AND THIRST.

(a) Coffee and brandy.

Coffee ... ... 6 ounces (T. 100° F.).
Brandy ... ... 1 ounce.

(b) Saline and brandy.

Salt solution ... ... (1 dram to pint) 18 ounces (T. 100° F.).
Brandy ... ... 2 ounces.

Inject with catheter and funnel.

INFUSION OF SALINE, EITHER INTRAVENOUS OR CONTINUOUS SUBCUTANEOUS.

Salt ... ... 1 dram.
Water ... ... 1 pint (T. 105° F.).

NUTRIENT ENEMATA.

(a) Pancreatized milk or beef-tea ... 8 ounces.
Two eggs (entire).
Port wine ... ... 1 ounce.
Arrowroot ... . ½ ounce.
Salt ... ... ½ dram.
To be given every 8 hours.

(b) Pancreatized milk or beef-tea ... 4 ounces.
One egg.
Salt ... ... ½ dram.
To be given every four hours.

Peptonized milk may be substituted for pancreatized milk in these enemata.

MOUTH-WASHES.

(*a*)	Carbolic acid	1 part.
	Water (warm)	80 parts.
(*b*)	Peroxide of hydrogen warmed.	
(*c*)	Lemon-juice	1 part.
	Borax	1 part.
	Glycerine	1 part.
(*d*)	Lemon-juice	1 part.
	Soda-water	1 part.
(*e*)	Liquor potassæ	1 part.
	Carbolic acid	1 part.
	Warm water	100 parts.
(*f*)	Potassium bicarbonate	10 grains.
	Carbolic acid	$\frac{1}{2}$ grain.
	Aqua rosæ	1 ounce.
(*g*)	Cunningham's.	
	Carbolic acid	gr.v.
	Saccharine (Sol. Ex. Sod. Bicarb.)	gr. ss.
	Olei Gaultheriæ } Olei menth. pip. } ... āā	♏ $\frac{1}{6}$.
	Tinct. aurantii	♏iv.
	Sodii benzoatis	gr.x.
	Sacch. ust.	q.s.
	Sol. thymolis ex aqua ad sat.	℥i.

EYE DROPS.

NITRATE OF SILVER EYE DROPS.

Nitrate of silver	2, 3, 5 or 10 grains.
Water (distilled)	1 ounce.

ATROPINE DROPS.

Sulphate of atropine	1, 2, or 4 grains.
Distilled water	1 ounce.

COCAINE DROPS.

Cocaine hydrochloride	10 grains.
Distilled water	1 ounce.

HOMATROPINE DROPS.

Homatropine hydrobromide ...	2 or 4 grains.
Distilled water	1 ounce.

ESERINE DROPS.

Physostigmine	$\frac{1}{4}$ grain.
Distilled water	1 ounce.

CHLORIDE OF ZINC DROPS.

Chloride of zinc	2 grains.
Distilled water	1 ounce.

NASAL FEEDS.

(*a*)	Milk	18 ounces.
	Two eggs.	
	Brandy	$1\frac{1}{2}$ ounces.
	Salt q.s.	
(*b*)	Beef-tea	10 ounces.
	Salt q.s.	

DUSTING-POWDERS.

(*a*)	Starch, Zinc oxide, Borax	Equal parts of each.
(*b*)	Calomel	1 part.
	Zinc oxide	3 parts.

ZINC PASTE.

Oxide of zinc	1 ounce.
Glycerine	2 ounces.
Methylated spirit	1 ounce.

Pour the glycerine on the zinc and let it stand for one hour; mix well, adding the methylated spirit slowly.

TO PANCREATIZE MILK.

Dilute 1 pint of milk with $\frac{1}{4}$ pint of water, divide into equal portions. Heat one portion to boiling-point and then add the cold to it. Add two teaspoonfuls of liquor pancreaticus (Benger) and 20 grains of potassium bicarbonatis. Mix well, and leave in a covered jug in a warm place for one-half to two hours. Boil for two or three minutes, and then cool rapidly, or keep on ice till used.

TO PEPTONIZE MILK.

To 1 pint of milk add $\frac{1}{4}$ pint of water. Divide the quantity and bring half to boiling-point. Add the other half and then add one Fairchild's Peptonizing Powder, and let stand for ten minutes. Bring to boiling-point and stand on ice.

BARLEY-WATER.

Prepared barley in powder ...	1 dram.
Boiling water	1 pint.

Boil for five minutes and keep in a cool place.

EGG WHITE SOLUTION.

Take the white of a raw egg, cut it in various portions with a clean pair of scissors. Shake up with a pinch of salt and $\frac{1}{2}$ pint of cold water, and strain through muslin. A little white sugar or some Liebig's Extract dissolved in a little warm water may be used as a flavour instead of salt.

RAW MEAT JUICE.

Scrape $\frac{1}{4}$ lb. of lean raw beef into a saucer Cover with cold water and leave for an hour in a cool place protected from dust. Then strain through muslin.

SUBCUTANEOUS FEEDING.

Inject sterilized olive-oil 10 c.c. under the skin at different places with antiseptic precautions. Not more than 40 c.c. should be given in a day.

TEST MEALS.

(*a*)	Minced beef	4 ounces.
	Toast	4 ounces.
	Tea without milk	1 pint.
	To be recovered in two hours.	
(*b*)	Toast	4 ounces.
	Tea with milk	1 pint.
	One egg beaten up or lightly boiled.	
	To be recovered in two hours.	

WEIGHTS (Avoirdupois Weight).

1 grain	Symbol, gr.
437·5 grains	1 ounce.
16 ounces	1 pound, lb.

The scruple (20 grains, symbol, ℈) is rarely used.

The dram or drachm (60 grains, symbol ʒ) is commonly used, but is not official.

Apothecaries' weight, in which the ounce is 480 grains, is obsolete.

MEASURE OF CAPACITY.

1 minim	Symbol, ♏.
60 minims	1 fluid dram (symbol, ʒ).
8 fluid drams	1 fluid ounce (symbol, ℥).
20 fluid ounces	1 pint (symbol, O).
8 pints	1 gallon.

METRICAL SYSTEM.

This is official on the Continent.

1 Milligramme	... ...	0·001 gramme.
1 Centigramme	... ...	0·01 do.
1 Decigramme	... ...	·0·1 do.
1 Gramme.		
1 Decagramme	... ...	10 grammes.
1 Hectogramme	... ...	100 do.
1 Kilogramme	... ...	1000 do.

MEASURES.

1 Millilitre	... ...	1 cubic centimetre
1 Centilitre	... ...	10 do.
1 Decilitre	... ...	100 do.
1 Litre	... ...	1000 do.

CONVERSION OF BRITISH TO METRICAL WEIGHTS.

1 grain	... ...	·0648 grams.
1 ounce	... ...	28·3495 do.
1 pound	... ...	453·5925 do.
		(a little under ½ kilo).

MEASURES.

1 minim	... ...	0·059 cubic centimetres.
1 dram	... ...	3·550 do.
1 ounce	... ...	28·397 do.
1 pint	... ...	567·932 do.
		(*i.e.*, over ½ litre)

DOMESTIC MEASURES.

A teaspoonful	... ...	1 fluid dram.
A dessertspoonful	... ...	2 fluid drams.
A tablespoonful	... ...	½ fluid ounce.
A wineglassful	... ...	1½ to 2 fluid ounces.
A teacupful	... ...	5 fluid ounces.
A tumblerful	... ...	½ pint.

A drop is often taken as a minim.

LIST OF PHRASES AND ABBREVIATIONS COMMONLY USED IN THE WRITING OF PRESCRIPTIONS.

āā.	ana.	of each.
ad.	adde.	add.
ad lib.	ad libitum.	as much as desired.
æq.	æquales.	equal.
aq.	aqua.	water.
bis ind.	bis indies.	twice a day.
c.	cum.	with.
c.m.	cras mane.	to-morrow morning.
c.n.	cras nocti.	to-morrow night.
c.v.	cras vesperi.	to morrow evening.
d.	dosis.	a dose.
d.	da.	give.
ft.	fiat	make.
gutt.	guttæ.	drops.
h.s.	hora somni.	bedtime.
ind.	indies.	daily.
mit.	mitte.	send.
mor. dic.	more dictu.	as directed.
o.m.	omne mane.	every morning.
omni hor.	omni horâ.	every hour.
o.n.	omni nocti.	every night.
p.r.n.	pro re nata.	when required.
q.s.	quantum sufficit.	a sufficient quantity.
r.	recipe.	take.
rep.	repitatus.	repeat.
sum.	sumendum.	let it be taken.
sæp.	sæpe.	often.
s.o.s.	si opus sit.	if necessary.
t.d.	ter die.	three times a day.

INDEX

THE END

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Symptoms

3 stages

Shock	Haemorrhage	Asphyxia
Pallor (bluish)	Pallor (blanched)	I
Pulse feeble.	~~Pulse~~ soft, full increasing in rapidly	Increasing dyspn...
Resp. Shallow	Resp quickened + sighing	Lips blu... puff...
Inactive	Restless	II
Vomiting	Vomiting	Convuls... Cla...
	Syncope	Resp, m... violent
Temp Subnormal	Temp Subnormal	Convuls...
Dilated pupils	Dilated pupils	Heart f...
Cold, clammy sweat		ma...
		Colour ...
		III ...
		Resp Sha...
		frequent...
		ceasi...
		Heart b...
		feeble ...
		infrequ...
		Lips pa...
		& anaes...
		Death o...